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ABSTRACT

This quarterly publication contains annotated bibliographic references screened from a select number of some 489 current United States and foreign publications on science (including technology and engineering) policy, as well as a small number of articles. This issue contains 407 bibliographic citations and four articles. The first article entitled "Technology in the United States: The Options Before Us," offers a set of options that U. S. policy makers can choose from to bring about more effective use of technology for the solution of today's problems. The second article, "Energy R & D Planning," attends to the question of whether or not our future energy needs can be met. The third, "On the Logistics of Talent," stresses the need for the discovery and nurture of scientific talent; and lastly, the fourth article, "Technology Assessment Act of 1972, Conference Report," describes the design of an Office of Technology Assessment, as prescribed by the Senate and House. A list of publications screened for this issue follows. (LK)

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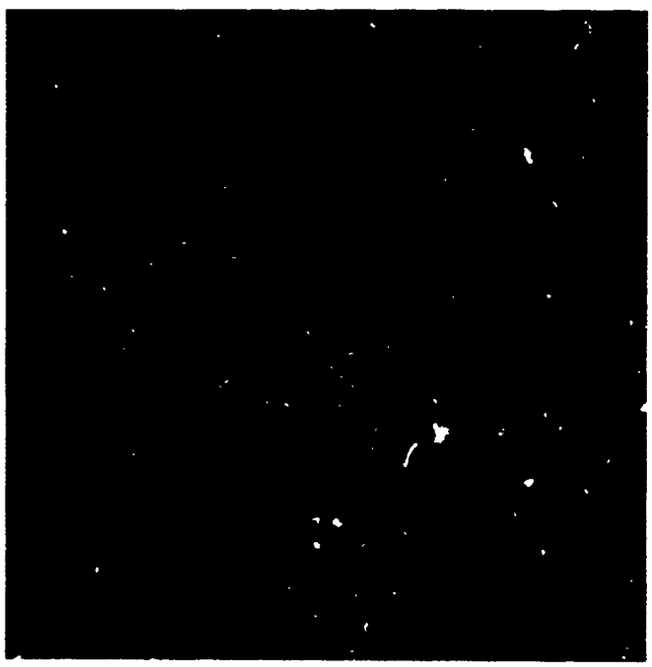

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Managing Editor, Clyde R. Tipton, Jr.; Editor, Eugene M. Simons; Assistant Editor, Dorothy J. Wallace; Circulation, L. Judith Sellers

Science Policy Reviews is a current-awareness journal designed for persons interested in the interactions of public policy with science and technology. Its contents are of two types: (1) feature articles in the form of invited papers, commentaries, speeches, reviews of timely topics, or reprints of particularly significant articles published elsewhere, and (2) annotated reference to recent books, reports, news releases, brochures, and periodical literature (see list on last pages).

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Contents

Taming Technology

Much attention has been focused recently on the need to use technology effectively to overcome the ills of modern society. Before one can discuss how this should be done, he has to pinpoint exactly what those ills are and how they came about. Our author has done just that.

Dr. J. Herbert Hollomon, former Assistant Secretary of Commerce for Science and Technology and current Director of MIT'S Center for the Study of Policy Alternatives, recently published a two-part treatise on U.S. technology, the first part entitled "Issues for the 1970's", and the second "The Options Before Us". The latter, reproduced here, begins with a concise summary of the technology-related problems described in the first article, spells out eight options (not mutually exclusive) for dealing with them, and describes the possible consequences of each.

TECHNOLOGY IN THE UNITED STATES: THE OPTIONS BEFORE US*

by J. Herbert Hollomon

In the first installment of this essay, we have identified and described a number of problems relating industrial progress, research and development policy, and scientific and engineering manpower which now confront the U.S. Briefly summarized, these observations are:

- The economy of the United States has evolved from agricultural to industrial to service-based. Past improvements in productivity have come largely from the agricultural and manufacturing sectors.
- The growing and widespread social consequences of industrial activity and the use of certain products have only recently begun to receive significant technical attention or government action and must be considered in the future industrial development of the society.
- As technology has spread throughout the world, competition from overseas has grown and can be expected to continue. The growth of the Common Market in Europe and the World Market for Japan gives to each of these economic units many of the advantages that the United States has enjoyed uniquely in the past.
- The system for educating scientists and engineers in the U.S. has been geared to meeting an ever-growing demand, largely based on the growth of space and defense programs. Recent decreases in their support have led to unemployment and declining salaries and will continue to do so unless other actions are taken.
- The prices paid for scientists and engineers have been inflated significantly more than other salaries and wages in the economy. The cost of all scientific and technical activity, whether aimed at increasing industrial productivity, improving technical capabilities, or dealing with social problems, has increased out of proportion to other costs.
- While support for research and development to improve health services and aviation has grown, total public expenditures supporting research and development for education, the criminal justice system, nonaviation transportation, health care delivery, and the disposal and treatment of waste are almost insignificant.
- Increases in productivity do not come directly from research and development alone; they involve experience in manufacturing, the supply of services, the diffusion of old technology, and public support for a social climate that encourages and adapts to change.
- There is a good correlation between

industrial growth, productivity, and investments in research and development for many industrial activities; the correlation is less good for the electronics and aviation industries, which may be less effective in exploiting research and development than other industries that received less governmental support.

- Second-order indirect social costs of technological change have seldom been considered in the calculations of its costs and benefits.

- Recent studies indicate that research and development expenditures correlate positively with profitability, but the correlation is much less certain than indicated in studies made in the early 1960s; the profitability of research and development may have declined.

- Large investments in research and development are typical of growing industries and may contribute to their growth and profitability. Less dynamic and older industries support relatively less research and development, and this may further depress their growth.

- The primary processes of technical change, at least in relation to civil activities, may depend less on new research and development than on ingenious applications of old techniques in response to market demands.

We concluded that these issues in relation to present U.S. social problems make clear the need for revision of U.S. policies relating to technology and its use in the society. But we cautioned that our analysis of past policies also makes clear the need for a better understanding of the effects of research and development policy as we analyze future alternatives.

The several policy alternatives that follow are an attempt to enumerate possible courses from which we might choose in order to make more effective use of technology in society. Even though the studies and analyses of past policies are inadequate, our present situation clearly demands the consideration of immediate action. The options presented are discrete; their possible interrelationships in combinations of two or more have not been considered here, although they would have to be considered were they to be proposed as federal policy. Some options exclude others, some do not.

Option 1. Take No Specific New Actions

One policy option is to allow present trends to continue and to take no new policy actions aimed at making technology more effective in our society. A continuation of past policies will lead to continued and growing federal support for research and development as well as support for technical activities to improve the delivery of public services (such as health, education, and transport) and alleviate societal problems (such as crime). This kind of non-defense, non-space activity has grown during the past ten years at the rate of approximately 12 per cent per year, and we will assume a continuation of this growth for the future.

If we pursue the policies of the recent past, the relative decrease in research and development related to military activities will not occur as rapidly in the future as it has recently, and the percentage of G.N.P. will level off at approximately 2.7. We assume then that the growth of industrial research and development as a fraction of G.N.P. will continue as it has for the last decade or two; no new conflict will generate new technical demands for hardware, and real per capita G.N.P will grow approximately 2.5 per cent per year.

This set of assumptions obviously is based on a continuation of present policies that deal with the social consequences of technological change, a renewal of economic growth, and a continued decline in military commitments. Under these conditions production increases will result largely from the re-employment of the physical and human plant that is now partially unemployed. The productivity of the services sector will not increase substantially. The overall decline in the demand for technically trained manpower in comparison with its supply will continue for the new few years. As a

result of excess supply, the prices paid for scientists and engineers will continue to fall relative to other wages and salaries. The number of college students who opt for the physical sciences and engineering will decline, eventually causing a decline in the supply.

Based upon the assumptions made about the national economy and using a supply/demand model for scientific manpower, Richard B. Freeman has predicted the number of trained people that will be produced in the future. His model predicts a substantial change in the supply of scientists and engineers in the late 1970s. Allen M. Cartter (who both vastly overestimates the supply and underestimates the demand) and others have also presented analyses of future trends in the supply and demand for scientists, but their analyses do not consider the delayed, yet significant, response of students to changing market conditions. Consideration of market phenomena leads to a prediction that one-quarter as many Ph.D. physicists will be produced in 1980 as are predicted by trend-extrapolation techniques. About three-quarters as many doctorates in engineering will be granted in 1980 as were granted in 1970. An equilibration of the supply and the then-growing industrially- and publicly-supported demand is predicted by approximately 1975. At that time, the relative prices for scientists and engineers and the cost of research and development will stop declining. Industry will have increased its commitment to all kinds of technical activities as a result of reduced costs. Although the supply of science and engineering graduates will be roughly equal to demand, a far smaller number will be graduating in 1975 than in 1970. Following 1980 the decrease in the college-age population in the United States may lessen the demand for scientifically and technically trained manpower in colleges and universities, but this will be partly offset by the growing demands in other sectors.

The positive consequence of this policy alternative would be an increase of 25 per cent to 30 per cent in the overall technical activity in the United States by the end of the 1970s. This increase, largely the result of the reduced cost of scientific and technical people, should lead in the long run to some improvement in productivity, in the supply of new products, and in the effective use of technical people to moderate the social consequences of technological change.

The negative aspect of this alternative would be its failure to decrease the current unemployment of scientists and engineers, resulting in an adjustment period of four to five years in which the potential contributions of unemployed, or underemployed, technical people would not be realized. The pool of scientists and engineers would decline not only by attrition but because of the high obsolescence rate of their skills if not continually used.

Furthermore, this alternative would allow no *new* major commitments to pressing social problems, such as the improved delivery of services or the amelioration of the indirect effects of technology employed in the past. Neither would this alternative correct the underinvestment inherent in innovative activity by industry, nor would it create any additional activity aimed specifically at alleviating the growing disparity between foreign and U.S. technical capabilities in non-defense, non-space pursuits.

Option 2. Directly Support Private Technical Efforts

Economists have long known that in competitive free markets the single firm cannot capture all the benefits of its innovation, though it must bear the major costs. Furthermore, if the cost of the innovation is high compared with the financial capability of the firm, the risks, related either to possible failure in the market or to uncertainties about the success of developing the technology, may be too great for the firm to accept. There are also social and political obstacles to innovation related to the acceptance of new products or processes and the social and human adjustments that must occur as a result of the innovation.

In the last two decades the rising costs (salaries) of U.S. scientists and engineers documented previously have so raised the costs of innovative activity in private industry as to considerably deter it. The inflated salaries and the decrease in the growth of technical activity may have been a factor in the decreasing rate of productivity increases in the private sector; productivity increases in the period 1966-71 were about half that per unit input of the preceding two decades. Inflated salaries certainly contributed to the current situation in which Japan can employ two to three times as many scientists and engineers as the United States for an equivalent expenditure and, therefore, can effect technological innovations at lower relative costs than the United States while taking advantage of U.S. technology through the purchase of patent rights and know-how.

All these factors suggest a national policy and program that would reduce the costs to the private sector of invention, innovation, and diffusion of technology. Whether the private sector produces the goods and services that best benefit society can be viewed as a separate question. Separate policies can create incentives and disincentives to alter the direction of industrial activity. The latter can be achieved through such means as pollution controls or the creation of a market for new public services; but whatever the direction of industrial activity and the social, political, or economic goals, the processes of invention, innovation, and the diffusion of technology must accompany them.

One mechanism that would reduce the costs of innovation to the private sector is a direct subsidy or tax credit for industrial research and development. A 35 per cent subsidy of industry's research and development costs would simply return the costs of technical activities relative to other costs to the level at which they existed prior to the major distortion introduced by the large federal research and development involvement of the 1950s and 1960s. Since all technical salaries have been inflated and since research and development is only one of the modes of innovative change, this size of subsidy of a firm's total technical effort could theoretically be justified. Obviously, the subsidy would stimulate the demand for scientists and engineers and maintain the high prices now paid to them. Indeed, the fact that the benefits of innovation are not fully appropriable might argue for the maintenance of a small subsidy for all innovative technical work; however, this is probably politically impractical.

Such a subsidy could be provided, either for all research and development investments made by a firm or for incremental research and development investments above a certain historically determined base. The latter proposal more reasonably meets the argument that research and development now supported by firms is economically justified and should not be subsidized. It has the advantage of leaving investment decisions closely coupled with market conditions and tends to correct the inflation of costs now present in the entire industrial system with respect to technology. However, the size of the subsidy must be carefully considered. Too large a subsidy would encourage high salaries as it increases employment.

Audits and Controls

The arguments against such tax credits center on anticipated administrative difficulties rather than on questions of economic principle. Any subsidy would encourage individual firms to call many industrial activities research and development in order to reduce costs and increase profitability. This difficulty might be overcome by recognizing that increased research and development must be accomplished by employing more scientists and engineers, an action which certainly could be subject to audit. In addition, data collected by the Bureau of Census and the National Science Foundation indicating long-term trends could serve as a basis for judging whether increases in research and development were in fact stimulated by the tax subsidy. Since about 90 per cent of all research and development in industry is conducted in 300 large firms, the policy of

tax credits would not seem impossible to implement, although one function of the tax credit would be to encourage smaller firms to engage in research and development.

Some argue, too, that the tax system should be concerned only with collecting revenues and not with correcting difficulties inherent in the economy. Others argue ideologically that federal subsidies should be based on political judgments of what is "good" for the society, that the issue should not be left to forces of the market and public regulation. It is clear that a tax subsidy will not necessarily encourage investments in those activities that deal with the broad social needs of the society. These needs will have to be supported directly or stimulated separately in private industry by imposing specific incentives or disincentives. This argument implies that the policies for encouraging the *processes* of technological change can and should be separated from the policies affecting the *purposes* to which the processes are applied.

Innovative industrial activity can be stimulated by other means as well. The technical base – i.e., the state of the art – on which technological innovation takes place in industry could be, as it is now in part, supported directly by government. Two activities basic to improving industrial output are the development of the production process, which involves automation, management, and the design of production equipment; and the development of design methods and techniques for new products. These activities could be supported directly in technical schools and universities as investments in the technical base of the society and as a way to influence the training of young scientists and engineers toward concern for industrial problems. This support would be similar to that now provided by the defense and space agencies which, to encourage the advance of certain technologies, subsidize research and the training of people within specialties basic to their missions.

Support for Basic Science and Engineering

There has been little question that certain scientific and technical efforts were necessary to develop the resources subsequently used in the space and defense effort. Analogously, it might be desirable to provide support for the non-appropriable work required to sustain the technology and science underlying industrial innovation. This support, primarily through grants to universities, would reduce the technical risks of innovation and would provide new, effective couplings between universities and industry. Perhaps grants to universities might be restricted to those cases that offer some assurance of industrial cooperation, possibly through associations or through matching grants by industry. The potential effectiveness of this mechanism can be supported by studies of defense-related innovations, which clearly indicate that a disproportionate number of the individuals involved in defense innovation came from those schools that received large amounts of defense research support.

One way to estimate the relative size of such a support program would be by considering the ratio of support given universities by defense and space agencies to the agencies' total research and development activities. This ratio was 3.4 per cent for defense and 3.3 per cent for space in 1969. Since the total of industrially-supported research and development is roughly $12 billion, the level of support given universities might be on the order of $400 million. To best connect university activities with industrial needs, it might be desirable to establish a program in which both government and industry participate.

Basic civilian science and technology might also be encouraged by establishing a series of government- and industry-supported research institutes coupled to universities. These would be similar to the Max Planck Institutes in West Germany, which were largely responsible for the great scientific strength of Germany in the early part of this century and appear to be a significant

means for closely coupling university science and industrial technology in West Germany today. While Great Britain's public support for industrial research associations has been criticized, the United States might explore the underlying idea of connecting the universities to associative activities. Most industrialized countries other than the United States have used this mechanism to achieve the diffusion of technology; the United States might find this kind of association an effective mechanism for improving the capability of the vast majority of small firms that cannot afford to perform their own research and development.

Option 3. Indirectly Support Private Technical Efforts

As indicated previously, industrial innovation appears to be most successfully encouraged by the "pull" of market demand. New agglomerations of markets and increased demand encourage investments in research and development by reducing market risk, while declines in demand often retard investment in technology. There is little doubt that the low investment in technology in such U.S. industries as shoes and textiles is related to their relatively slow growth. Other factors that characterize a conservative, change-resistant enterprise are probably involved in the construction industry's failure to capitalize on research and development: restrictive labor practices, product codes, and standards aimed at protecting vested interests.

It is also true that – particularly in housing – firms are often small and unable to undertake the high-risk technical activities required to bring about rapid product improvement or significant efficiencies. Ezra Ehrenkrantz has demonstrated that when the individual requirements for a number of new school buildings in California were consolidated into a single performance specification, industry responded with innovative ideas that permitted the construction of more efficient buildings.

Textile and shoe manufacturers could apply this lesson by agreeing to set performance standards for radical new machinery; without such radical technological change, these industries may be unable to compete with foreign firms paying significantly lower wages. With encouragement by federal subsidy, research and development might be stimulated by the prospect of a new, large market for shoe and textile equipment. Increased domestic production of advanced machinery would have the additional effect of reducing the present importation of machinery and might even stimulate an export market. As a large purchaser of civilian goods, the federal government could agree on performance specifications that require industrial innovation and pay for the prototype development to reduce both market and technical risks to suppliers. A program of this type was initiated several years ago by the General Services Administration for the development of government administrative buildings and could be extended to food products, clothing, medicinals, and any goods the government buys in large quantities.

Techniques developed as a result of this mechanism should be directly applicable to the production of goods for the civilian market. Evidence of the effectiveness of this technique of "pulling" technology has been established by computers, airplanes, and integrated circuits produced originally for the federal government that now have extensive commercial markets. The federal government could extend this mechanism by requiring, for example, that hospitals receiving federal support be constructed through cooperative efforts that set performance standards for successive buildings.

Other indirect means exist for encouraging technical development in firms or industries with little knowledge of modern techniques. A novel notion now being tried in Canada is to support the education of graduate students partly through direct grants and require them to work in industry for the remaining support for their graduate activity. Such a program might stimulate the industries themselves to support other people. Students, in turn, would be stimulated to be knowledgeable about the problems of the

industry supporting their education. Government could receive benefits similar to industry by initiating apprentice programs within government agencies.

Option 4. Improve the Services Sector

With half of our workers engaged in providing services, the United States has become the first post-industrial society. The fastest growing services are health, education, and local and state governments. These services are provided by a large number of diverse establishments, few of which are able to support the technical efforts necessary to improve their efficiency or effectiveness. The fire-fighting, police, welfare, road building, and sanitation activities of local governments, for example, have not benefited significantly from advances in technology.

The services sector might be likened to highly fragmented industries; but lacking the discipline of a profit motive. Technological innovation is discouraged in the institutions that supply education and health services, for example, by their structures and incentive systems which inherently discourage cost-reducing changes. In these institutions, the individuals who determine the system's operating characteristics and level of effectiveness -- for example, doctors and teachers -- do not have much incentive to reduce costs. Indeed, they often find it convenient to increase delivery costs, since they are not forced to bear any of them directly.

Yet there are technologies basic to each of the several components of the service sector which could, if used, improve the effectiveness of the services they supply. Community health plans that associate medical facilities with treatment and provide financial incentives to reduce health care costs may be one way of restructuring the health delivery system to encourage innovation and improved service. Although no equivalent scheme for improving either schooling or government services has yet been tested, the soaring costs of services and decreased growth in demand for them will begin to induce a climate for innovation to improve their effectiveness and efficiency.

Improvements in government, health, and education services involve invention, innovation, and diffusion as do the other sectors of the economy. These processes must be supported either directly by the government or by individual institutions under incentives to support the innovative process themselves. Currently, the percentage of research and development allocated to improve public services is small compared with the total costs of providing those services. Correlations between productivity improvements and research and development in industry may serve as a basis for estimating the amount of research and development that could be justified for health and education services. Growing and profitable industries devote at least 4 per cent of their sales revenue to research and development. A level that is 3 per cent of the total health and education services expenditure would require a public research and development investment of $5 billion. It must be remembered, however, that no amount of research and development, invention, or even preliminary innovation is sufficient to ensure that changes will be adopted broadly and diffused throughout the services sector; the institutions themselves must accept the changes that are devised.

As in manufacturing, there are techniques connected with the storage, manipulation, recovery, and analysis of information that are basic to each of the components of the services sector: in education, the science and technology of learning and teaching; in health care delivery, the technologies associated with testing, diagnosis, and prevention of sickness (rather than the cure of disease); in government, the application of operational analysis and control procedures to such activities as fire-fighting and the allocation of police resources have already been demonstrated. These techniques could be developed for the services sector by the universities with the support of research and development and the encouragement of cooperative arrangements.

In addition to the services of government, health, and education, there are services

connected with industrial products; these, too, are costly and growing. The repair, maintenance, and disposal costs of durable consumer goods are high and increasing. Here, too, incentives to design more reliable and longer-lasting products are possible not only to reduce repair costs, the consumption of raw materials, and the pollution generated in manufacturing, but possibly to create new markets. The federal government could, for instance, purchase radically new products and require that they be maintained and disposed of by the producer. This method has the net effect of making the producer actually provide the *service* that the product is to render - reliably, and over an extended and definitive period of time. Considerable technology already has been developed for the military and space programs that could be used in the design of more durable consumer products. Currently, however, the producer and original buyer are concerned primarily with the initial product performance and have no way to adequately anticipate future repair, maintenance, and public disposal costs. Encouraging the sale of a consumer service rather than a consumer durable might provide a better way to produce goods at reduced total cost to individuals and to society.

Option 5. Support Training and Relocation of Displaced Workers

Workers are displaced and sometimes the economies of whole regions are depressed as a consequence of technological change. While there is no evidence that technology reduces employment in the long run or in the aggregate, change obviously causes local and often severe individual and social dislocations: workers with particular skills are displaced and may not find other employment; regions and cities, like Appalachia or Seattle, become economically depressed. The costs of the technical change are borne by the small number of people affected, while the benefits of the change flow to the society as a whole. Growth industries do have some incentives to retrain and relocate their workers as they expand to serve new markets and reduce their overall costs. However, in slowly growing industries, where the total number of jobs in the industry may be declining, displacements are particularly costly. The mere threat of displacement, as well as displacement itself, slows the innovative process and reduces further the competitiveness and growth of these industries. The textile, shoe, and fisheries industries in the United States are likely examples of this phenomenon.

Publicly supported retraining and relocation programs reduce the inequities induced by technological change and stimulate the overall process of change. There are today a number of such programs, some supported publicly and some privately. However, a more broadly based program paralleling those established in Sweden, West Germany, and – recently – France could be highly effective in the United States. France's imaginative new program, which might be called "educational welfare", requires the worker and his employer to contribute to an educational fund vested with the employee. The accumulated fund, after a certain initial period, may be used by the worker for training or education that improves his skills or makes him more adaptive to a new job. Such a fund, which could also be used to pay relocation costs to another region where jobs are more plentiful, encourages adult education and retraining; and the firm, and society, and the worker all share in the cost of retraining as they share in its benefits.

Even excluding such a scheme, a major review and overhaul of present training and relocation programs in the United States seem desirable. The legislation now under consideration that benefits only particular classes of workers, such as displaced scientists and engineers, does not seem equitable. Since the consequences of changes in public policy or technology affect many workers, an equitable program would be one that treats all workers alike and allocates the costs between worker, employer, and the public at large.

Option 6. Support High-Risk Ventures

A number of studies indicate that a disproportionately large number of major inventions and innovations come from private inventors and small, innovative firms — especially research and development firms. The private inventor and the small firm alike face the extraordinarily difficult task of obtaining early development support for ideas that have not yet proven to be feasible technically or to lead to saleable products. While the individual inventor or new firm must bear or find support for initial costs, the costs of inventive and innovative activity in large and profitable firms can be treated as an expense within the present tax structure; such costs are deductible as future benefit costs, and, in a sense, are partially supported by a reduction in the taxes of the firm. No similar tax benefit flows to the private inventor or the fledgling firm not yet in business; however, there are some loss-carry-forward benefits if the firm "survives", and these could be extended. As suggested earlier, there are arguments to support a tax reduction for incremental research and development, but such a tax reduction would benefit only existing large firms. Yet large firms with large technical and marketing organizations and complex plants often are unwilling to invest in inventions or innovations that are new to their business or that may not be directly applicable to them. The establishment of a negative income tax for the first few years of a new firm's life, however, would give a benefit to the new firm analogous to the tax reduction on research and development for established firms.

A publicly supported organization that provided high-risk, early support to private inventors or small firms in exchange for a share of the equity would also help bring new concepts to the stage where the enterprise system could more readily evaluate the technical and market risks. The judgment for support and the amount of equity should be based on an assessment of opportunity for each case. Over the long run, it is likely that an institution that supported very high early risks could be self-supporting. Because an inventor or entrepreneur usually needs advice concerning the availability of venture capital, business techniques, and marketing, the organization that furnishes the early-risk capital could also arrange to have business schools, which use faculty and others with practical, entrepreneurial experience, provide this expertise.

Option 7. Improve the Transfer of Technology

During the post-war reconstruction of Europe and Japan, the United States had little incentive to seek out new technological developments from abroad or to be concerned about the patent rights and know-how obtained from foreign firms. Indeed, the flow of innovation was presumed to be from the U.S. to overseas users; we provided capital and know-how to Europe and encouraged the manufacture of certain military goods in Japan.

We have limited the flow of technology to the Soviet Union and its satellites, and prevented the flow to the People's Republic of China on ideological, political, and military grounds. Economics have not been seriously considered. During our two post-war decades of leadership in science and technology, particularly in space and defense, we became convinced of our scientific and technological superiority and even stimulated the Europeans — especially the French — to be concerned with an irreducible "technological gap" – a hue and cry which in recent years seems to have been muted.

Now the situation is quite different. The negative as well as the positive consequences of our past federally supported programs are more evident and more carefully considered. We are beginning to understand the consequences of our failure to recognize the need for public policies and programs to improve productivity and to ameliorate the systemic and deleterious consequences of our system of production and consumption. Any flow of technology between nations, like any flow of trade, is

generally conceded to be beneficial in the long term. But how foreign technology should be paid for and what are the best means for making more available the technological knowledge developed abroad remains unclear. The United States still has a large balance of payments in its favor for the purchase of patent rights and know-how. The original developments that led to this favorable balance were based on the state of the art and on technical activity supported by the general public and appropriated by the inventor or the innovator. Would it not, therefore, be reasonable for the United States to tax transfer payments made by foreigners for patent rights in order to recover some of the general social investment and thereby make the prices more realistic? Since the cost of purchasing rights to successful inventions or innovations is usually much less than the cost of beginning afresh, a serious reduction in foreign acquisitions is unlikely if such a policy were implemented. Even if there were a reduction, would not the result be equitable and reduce some of the relative foreign advantage?

United-States-based multinational firms internally transfer know-how and also provide training and experience for foreign workers. Through the establishment of foreign branches, a United States firm may be able to enter markets not otherwise open to it and create a demand for U.S. exports that support the foreign production. Furthermore, these firms are able to obtain foreign technology from their overseas operations for use in the United States. Even so, there is the question of the extent to which these firms should enjoy special privileges of "free" transfer of U.S.-developed technology (as differentiated from science) or enjoy special tax benefits. The possibilities and consequences of taxing income earned abroad at the time it is earned, rather than when it is repatriated, might be examined.

Since the late 1940s the United States has subsidized the travel of many foreign nationals visiting and studying here. We should now capitalize on this program to develop new means for obtaining knowledge of the new applied science and technology developed abroad. Industrial associations could be supported to establish information centers abroad. Foreign travel and stipends for extended visits of United States scientists and engineers abroad could be augmented.

The "science attachés" in our embassies abroad have heretofore been concerned primarily with the exchange of scientists and scientific information and with cooperative efforts related to national programs of defense, space, atomic energy, and health. A similar and substantially greater effort to assist in obtaining technology affecting industrial productivity and environmental effects would now appear to be justified. Though only a small number of people would serve in this role, they might act as catalysts to aid in changing the view of U.S. firms and technicians toward the greater exploitation of techniques developed abroad. Like other countries, the United States must choose the fields in which it will concentrate its technical resources, and buy technology wherever possible. In the future, unlike the past, there will be many fields in which one nation or another leads the United States — and we must adjust to this new circumstance.

Through its year of technological leadership, U.S. engineers have developed a "not-invented-here" complex. They don't believe they have anything to learn from foreigners. They would rather reinvent than learn from others. The contrast with attitudes of Japanese engineers is especially striking. The Japanese are prepared to take the best from anywhere and really learn it thoroughly to the point where they can improve it.

Option 8. Ameliorate the Consequences of Technological Change

We know that a number of major social and environmental problems have arisen as a result of the widespread use of technology and the concurrent changes in the social, physical, and political environments. Serious questions have been raised about

the stability of our growing and changing system, about the relationship between private benefits and social costs of technology, and about the ethics and values basic to our society.

The Renaissance, the Reformation, the Scientific Enlightenment, and the Industrial Revolution brought into being institutions and values that encourage individual success, the exploitation of resources, and the destruction of the common environment. Air, water, and land, as well as our aesthetic environment, are polluted as a consequence of uncontrolled individual activities which benefit those who initiate them but which do not lead to the long-term benefit of the society as a whole. The growing recognition of these harmful consequences is reflected in our re-examination of both the institutions and the norms of society – i.e., the literature of dissent.

In principle, the long-range consequences of physical pollution can be estimated by comparing the direct benefits and costs of continuing growth within the existing framework of society with the benefits and costs of technological change. True, the methods of measuring some forms of pollution are unavailable, the consequences unknown, and the possible mechanisms for correction undeveloped; but the basic issue is one of determining the limits of permissible pollution and applying incentives or disincentives to motivate the society to reach those levels.

Three types of activity are required to cure pollution. First, we must determine the harmful side-effects of various contaminants and develop methods of measurement. Second, we must determine permissible pollution levels and the social and economic mechanisms needed to achieve them. Third, we must learn the technology of contaminant reduction, how to substitute new means of production, or how to make products that are less polluting.

There are some who question whether the present economic and political systems can be patched to ameliorate even the physical consequences of technological change and the further economic growth pattern of our society. In the case of aesthetic pollution such as crowding, devastation of the landscape, ugly billboards, and uglier buildings the questions are more ethereal and, consequently, less quantifiable. The consequences of psychic distress expressed in the loss of production and increased crime and drug abuse are also only partly determinable. Indeed, these issues of aesthetic and psychic disturbances are more philosophic and religious, related to the deepest values of individuals in the society and of the institutions which they construct.

All of these distressing consequences are interrelated in ways that are little understood. Even so, there now exist activities that might with more public support contribute to the amelioration of the growing contamination of our environment and the destruction of our commonly held resources.

Until very recently almost all government programs associated with non-space, non-defense technology have been aimed at producing new goods and services without much consideration of the indirect consequences of their introduction into the society. For example, we know almost nothing about the total indirect costs of automotive transport; not only do combustion engines pollute, but automobiles lead to congestion and high traffic volume and parking costs in the central city. Determining the external or social costs of industrial processes and products is essential if we are to devise optimum ways of reducing these costs.

Nearly all of the present federal support programs aimed at meeting the energy crisis are devoted to improving the efficiency of or reducing the pollution in the generation and transmission of energy; almost none of the analysis, research and development that might lead to reducing the use of energy is being supported. Because direct energy costs are so low and because energy users are so diverse and diffuse, few incentives exist for technical programs to improve the effectiveness of the use of energy and thereby reduce the waste inherent in the energy production and use system.

As we determine social and external costs and ways of reducing the use of commonly held resources, the industrial system of the United States must be modified to reduce these costs and the destruction of common resources. The changes necessary to the system will sometimes act against the immediate self-interest of those affected and will surely be resisted. Social research and experimentation are necessary to determine those incentives and disincentives which balance long-term interest with the short run.

Changes that ameliorate contamination or reduce the exploitation of natural resources will be introduced by the same processes of invention, innovation, and diffusion as other technical changes. A highly sophisticated base of technical knowledge and appropriately trained people will be required to use this knowledge effectively. Though a great technical effort will be required to quantify the social costs of pollution and set standards that will reasonably balance costs and benefits, the change we need will be effected mostly by "pull" mechanisms. Support will be required for high-risk ventures, for reducing the risks of innovation, and for assuring the widespread diffusion of newly developed techniques.

National programs were initiated in the 19th century to encourage invention, innovation, and diffusion of technology to and for the American farmer. Activities of a similar scope seem necessary now to support the efficient use of products and services by highly fragmented consumers. Just as mining technology has been supported by the federal government for nearly two centuries, we might now develop an equivalent program aimed at recycling waste and reducing the consumption of natural raw material. Methods of monitoring environmental pollution and measuring its effects have begun to receive attention – but not sufficient to change the present pattern of growth. Additional schemes similar to those now being implemented for pollution controls for automobiles are needed to provide incentives for industry to invest in technological developments in the long-term interest of the society: programs for new institutional arrangements, for increased support of new subjects in universities, and for freeing those able to apply these subjects to the major social problems we face. The present apparatus of government, often designed to encourage and develop the interests of special groups, is ill-suited to carry forward such a major shift in national priorities or technical activities. There is, for example, no overall authoritative agency in government dealing with science and technology that can estimate and ameliorate the short- and long-range consequences of their application to the society. The often-suggested creation of a cabinet-level department for science and technology should be thoroughly considered.

Epilogue

We began with consideration of a changing world that requires new initiatives that might contribute to the continued growth and well-being of the United States. By growth we mean the growing improvement of the quality of life and the establishment of conditions leading to the preservation of that quality in the future. The effort and changes required will be large. We will need more skilled people and greater investments in science and technology. We will need a far greater knowledge of the processes by which invention, innovation, and diffusion occur, particularly in a society in which the free, individual enterprise system has to be altered so as to more automatically preserve the commonweal.

We do not sufficiently understand the mechanisms involved to be certain either of the consequences of our present patterns of growth or the best ways of changing them. We therefore require deeper knowledge of the functioning of our society and of the potential collective effects of individual actions. We have emphasized that technology and science, if we are to survive, require a growing appreciation of new values and new norms and a fuller appreciation of the self in all of us. It is in a time of change and uncertainty that fresh opportunities arise.

Let's Get Busy

The press has been full of mind-boggling dilemmas involving present and projected energy usage, fuel supplies, pollution, waste heat, radiation, and economics. Here, Dr. Chauncey Starr, Dean of the School of Engineering and Applied Science at UCLA, Vice-President of the National Academy of Engineering, and a member of President Nixon's Task Force on Science Policy, takes a pragmatic look into future energy supplies and demands and makes some suggestions.

This article doesn't supply the answers to our present energy system problems. But it does sort out the variables in this highly complex situation and tells us what must be done to provide a solid base for short-range and long-range energy planning on a national scale.

ENERGY R&D PLANNING

by Chauncey Starr

Energy and Societal Development

Long-range planning of our national energy systems must start with some conception of future energy demands. A conception of the future may come from a simple extension of historical trends, or may be developed from a more sophisticated analysis of changing life styles and their impact on individual needs. Since 1900, the average per capita energy consumption in the world and the U.S. has doubled every 50 years, with some short-term perturbations. There appears to be small likelihood that this long-term trend of increasing per capita use will change in the next several decades. In spite of increased public concern with the impacts of such a growth, there is actually very little that can be done pragmatically to limit it – other than direct scarcity or rationing – because of the intimate connection between the life styles of peoples, their aspirations, and the energy supply.

The future need for energy in societal development is of two broad types, one characteristic of the highly developed sections of the world and one typical of the underdeveloped portions. During the past two centuries the industrialized nations of the world significantly increased their energy production in order to sustain their population growth and to improve the welfare of their people. It is likely that in the next century the per capita energy consumption in these advanced countries will approach an equilibrium level, both because the quality of life for the majority of the population will be less dependent on increased energy use, and because environmental constraints will make energy more costly and thus encourage increased efficiency of its use. The hoped-for population equilibrium in advanced nations will also lead to an eventual leveling off of the total energy need for these countries.

For the underdeveloped part of the world, which contains most of the world's population, the situation is quite different. These peoples are still primarily engaged in maintaining a minimum level of subsistance. They have not, as yet, had available the power resources necessary for the transition to a literate, industrial, urban, and agriculturally advanced society. Historically, such transitions have always involved both an increase in population and an increase in per capita energy consumption. We are seeing this now in most of the underdeveloped countries. So, the inevitable population growth, combined with an increased per capita energy use, will result in an enormous worldwide energy need.

This gradual transition of the underdeveloped world to the industrial-urban-agricultural systems characteristic of the advanced countries will be significantly dependent on the availability of energy. It has often been suggested that because of its environmental impacts, energy use be arbitrarily limited everywhere. This re-

quires the same type of societal decision that would be associated with arbitrarily limiting water supply or food production. Given the objective of providing the people of the world as good a life as man's ingenuity can develop, the essential role of energy availability must be recognized. With the same motivation that causes the agronomists to seek an increased yield per acre, it is the function of technology to make energy available in sufficient amount to meet all essential needs, and with sufficiently small environmental impact as to ensure that the benefits outweigh all the costs. Because even in the industrial societies the per capita use of energy in large amounts is only a century old, and in most of the world it is not even started, we have both a growing need and an opportunity to develop long-range R&D plans for optimally supplying this essential aid to man's social development.

Natural Limitations

In the development of future concepts for our worldwide energy systems, there are a number of constraints established by nature. The most obvious of these is the depletion of resources for energy production. My estimate of those available in the economic range of twice present costs is shown in Table I.

The depletable supply of fossil fuel certainly appears adequate for some period beyond the year 2000, both for the world and the U.S. As has often been stated, nuclear fission provides another major resource – with the present light-water reactors about equal to the fossil fuels, and with the breeder reactors almost 100 times as much. The continuous supply of solar energy is, of course, an enormous resource we still do not know how to tap effectively. Not fully shown in Table I is the internal heat of the earth, of which only the natural steam sources are estimated. It has been proposed that tapping the heat in the rocks of the earth's crust is feasible, and if it is, this could be important. At present, the initial probing of this source has not yet been tried – so its pragmatic availability is yet uncertain.

It is clear from all such studies that for the next century, mankind is unlikely to run out of available energy. Instead, the important issue is whether the increasing cost of energy (including environmental costs) will become a handicap to societal improvement. Just as an increasing cost of water with increasing usage might limit the development of an area, the same could apply to the use of energy in various parts of the world.

Another natural constraint arises from waste-heat dissipation. This problem will always be with us and cannot be removed by technological ingenuity – all energy use eventually ends up as heat. All that technical development can do is alter its area concentrations. However, as is shown in Table I, the solar heat load on the atmosphere is so great that the incremental contribution likely to be made by man is not an important fraction thereof. What is of importance is the geographic and urban concentrations of energy dissipation which may alter natural and urban environments. Heat dissipation may be one of the long-range limitations on urban population density. At the present average U.S. power dissipation of 10 kilowatts thermal per capita, a population density of 30,000 people per square mile (half New York City's density) will produce waste heat equal to the average solar heat loading of the urban air basin.

Of the uncertain natural limitations, the effect of carbon dioxide – which is an inevitable end product of fossil fuel utilization – is as yet a long-term environmental mystery. The meterological data available indicate that this is not now a serious issue and may not ever be one. We do have at least several decades for determining the closed CO_2 cycle in our biosphere, and the equilibrium relationships. The alleviating development is the use of nuclear power. Nevertheless, it appears that we will always need a combustible fuel and, certainly, for several centuries this is likely to be a hydrocarbon in some form. If, however, the CO_2 problem were determined to be

TABLE I. ENERGY BALANCE SHEET

(in 10^{12} watts = terawatts = Tw and Tw years)

DEPLETABLE SUPPLY (Tw yr) (Economically recoverable)	WORLD			U.S.		
Coal	670	–	1000	160	–	230
Petroleum	100	–	200	20	–	35
Gas	70	–	170	20	–	35
Subtotal	840		1370	200		300
Nuclear – light water	~3,000			~300		
Nuclear – fast breeder	~300,000			~30,000		
CUMULATIVE DEMAND (Tw yr) (1960 to year 2000)	350	–	700	100	–	140

CONTINUOUS SUPPLY (Tw)	WORLD		U.S.	
	Reasonable Maximum	Possible by 2000	Reasonable Maximum	Possible by 2000
Solar Radiation	28,000		1,600	
Fuelwood	3	1.3	0.1	0.05
Farm waste	2	0.6	0.2	0.00
Photosynthesis fuel	8	0.01	0.5	0.001
Hydropower	3	1.	0.3	0.1
Wind power	0.1	0.001	0.01	0.001
Direct conversion	?	0.01	?	0.001
Space heating	0.6	0.006	0.01	0.001
Nonsolar				
Tidal	1.	0.06	0.1	0.06
Geothermal	0.06	0.006	0.01	0.006
Total	18	3	1.2	0.2
ANNUAL DEMAND (Tw) (year 2000)	~15		~5–6	

serious on a worldwide basis, there is an ultimate but very costly technological solution, and that is the use of electric power for the manufacture of hydrogen through electrochemical decomposition of water. Hydrogen would make an ideal fuel since its combustion provides water as an end product.

Long Lead Times Unavoidable

Within these natural limitations, man has tremendous scope for planning energy utilization. A partial list of the controlling factors which enter into energy planning is presented in Table 2. As shown, the only parameters under our control which can alter the nature and trends

TABLE 2. PARAMETERS FOR THE FUTURE

Individual Selection	Societal Selection	Economic Feasibility	Technical Feasibility	Natural Limitations
1*	10*	10	100*	100 – 1000*
$10^2 - 10^{4**}$	$10^6 - 10^{8**}$	$10^9 - 10^{11**}$		
Optional Uses Comfort Entertainment Communication Home Services Transportation Labor Aid, Tools *Criteria* Relative Costs Personal Safety Quality of Life Intangible and Subjective Biases	*Device Utilization* Central Station vs Local Power Plant Conversion Method Distribution Alternatives *Resource Development* Coal Oil & Natural Gas Nuclear Shale Oil Coal Gasification Fusion Solar *Siting Choices* At Fuel Source Close to User Esthetics Land Use Waste Disposal Water Disposal Environment *Regulation & Control* Legislation Regulations Standards	*Speculative Resources* Solar Power Biological Photosynthesis Fusion Fuel Cells MHD Direct Conversion *Alternative Fuels* Alcohol Liquid Hydrogen Ammonia *Environmental Effects* Recycle Wastes Waste Storage (radioactive) Safety		*Resources* Fossil Fuel Uranium *Continuous Sources* Solar, Fusion *Environmental Effects* Conversion Efficiency Regional Climatic Effects CO_2 Production

*Years required for implementation.
**Dollar costs involved.

of near-term energy systems are a limited number of individual and governmental choices – life style and value oriented rather than technological in nature. An individual choice of energy device (home heating, for example) can be made and implemented with a time constant of about a year. A choice by a societal unit (location of a power station, and effluent regulation, for example) takes about a decade to make and implement. Thus, the full effect of such societal decisions often doesn't develop until more than a decade has passed. In the technological domain of new economically acceptable energy devices, we are really working for the next generations, rather than our own. Even nuclear power, which was certainly supported by government as enthusiastically as any technology in history, has taken 25 years to establish a commercial base – and still hasn't made a real impact on our energy supply.

So, the development of new speculative energy resources is an investment for the future, not a means of remedying the problems of today. Unfortunately, many of these as yet uncertain and undeveloped sources of energy are often misleadingly cited publicly as having great promise for solving our present difficulties. In addition to their technical uncertainties, many of these speculative sources are likely to be limited in their contribution, even if successful. The attraction of "jam" tomorrow may persuade us to neglect the need for "bread and butter" today. Because of the

very long time required for any new energy device to become part of the technological structure of our society, even if successful, these speculative sources could not play a major role before the year 2000. Unfortunately, the quality of life of the peoples of the world depends upon the availability in the near future of large amounts of low cost energy in useful form. This being the case, we must plan an orderly development of the resources available to us now, and these are primarily fossil fuels and nuclear fission.

The time required to carry a concept through the R&D, pilot plant, and commercial prototype stages is of course dependent on the associated funding and priority. However, even a crisis approach can rarely reduce this sequence to less than a decade for a large engineering system. More usually, a scientific concept of proven feasibility may require two decades to reach commercial availability.

Prompt Planning Vital

It is for this reason that our recent environmental concerns and resulting governmental actions have caught the energy industry without the technology commercially available to meet these new objectives, creating both energy-resource and power crises. The public pressures of the past few years have certainly accelerated the necessary technological developments, and in time we should be able to have adequate energy systems and an acceptable environment. However, we must recognize that no one can guarantee the end result of a technological investigation because the unknown is an inherent element of the development program. Only multiple approaches to the same objective can provide assurance of finding a workable result.

The creation of future technological options is the principal function of applied research. Having many such options continuously appearing on the scene is an absolute essential for our societal development. Even though it takes decades to bring new concepts to fruition, we must make the needed investment so as to provide the future means of avoiding "crisis", "shock", and "catastrophe". The unpredictability of our long-range needs, pressures of geopolitics, societal objectives and value criteria emphasizes the need for having available many technological alternatives.

These comments are particularly pertinent to the energy area. In the past, energy resources were plentiful, power conversion machinery was adequate to do the job, costs were low, and environmental impacts were accepted. As more power was needed, we built more of the same – with small incremental improvements. Now we have become aware of pending resource limitations – for reasons of depletion, economics, geopolitics, and environmental concerns. Costs are bound to increase, environmental constraints are becoming more pressing, and we now seek new technological means. At present, we have only one ready to be used – nuclear power. It was a rare combination of a scientific happenstance and congressional foresight that gave us this new power source. It is a good illustration of the guiding principle that if you wish to be able to pull a rabbit out of the national hat, you must put it there beforehand.

As you know, even nuclear power has yet to reach the degree of development that will make it completely accepted socially. Although I am personally confident of its eventual acceptance, this is not a trivial task – and if we are not successful we have no evident recourse other than fossil fuels, which are already in trouble.

So, it is truly urgent that we carefully plan and implement our national R&D program on energy to create a variety of usable systems. There are so many parameters involved in such planning that their arrangement into a scenario becomes a matter of individual judgment – and a game that anyone who understands the range of choice and the interactions among the pieces can play. However, all the possible arrangements tend to focus attention on a limited number of crucial policy questions which are more sociological than technical in nature.

Questions on Energy Supply

The first set of questions has to do with the supply of energy. These might be succinctly stated as follows.

> Whose resources should be utilized?
> Where should power be generated?
> Who shall receive the pollution from such activities?

These questions are pertinent because fossil fuel resources can be shipped long distances by pipelines or by relatively inexpensive ocean transport, enriched uranium by any transportation system, and electric power by transmission lines. Thus, resources, power generation, and use may be geographically separated long distances.

Our present approach to fuel oil has resulted in an international network for the tapping of the world's resources. Until World War II, the United States was a net exporter of oil supplies. Today, the Middle East and Africa are the major suppliers of oil and they provide more than half of the world's fossil fuel resources. Because these supplier countries consider their indigenous oil an exportable commodity which provides a major source of their income, they are presently pleased to have us rely on their resources. However, there may come a time when these fuels will no longer be available to the U.S. Long-range planning to prepare for such eventualities obviously has to be included in any national planning of our energy systems.

An almost classical illustration of the issues associated with separation of source and user is the Four Corners power region development in the U.S. The Four Corners region where Utah, New Mexico, Arizona, and Colorado meet has available low sulfur coal in large amounts, cooling water from the Colorado River, and a low population density. Six coal-fired plants were intended to be built in this region to provide electric power primarily for the large cities of Los Angeles, Las Vegas, Phoenix, Albuquerque, and other urban communities of the Southwestern United States -- all distant from the Four Corners. In spite of the low population density of the Four Corners area, a considerable protest has arisen over the by-product environmental impacts on the surrounding countryside from the coal mining, combustion effluents, and water use. Although the social trade offs between divergent group interests will eventually be arrived at, this particular case epitomizes the key issues characteristic of large energy development centers geographically remote from the users.

The question of who gets the pollution, as contrasted with who gets the energy, is not only one of geographic distribution but also of time. For example, if as a result of the rapid increase in strip mining for coal, the acid drainage and soil erosion destroys the ecology of large regions, it may take decades to repair the ecological damage in spite of extensive restorative efforts by the coal mining industry. This generation of energy users will be long gone when the next generation faces the problem of repairing such ecological impact. Presumably, our present fossil fuel needs will justify such residual effects, but the case should be made.

The same issue of impacting future generations has been raised in connection with nuclear power. Although the residual health risk from radioactive waste from nuclear power has been a public concern, I believe the present level of nuclear power technology makes this risk so negligible as to be completely "safe" in laymen's terms. The long-time storage of nuclear waste is not technically or economically difficult and is not now a real problem. It is true, however, that such storage requires each generation to take over the management of the previously created wastes, but the amount is small and the task not difficult not much more than guarding the gold at Fort Knox. Considering the problems we pass on to the next generation in sociologic areas, this is a minor matter. However, the philosophic question must be considered. The burdens to the future generations are today's social choice.

Questions on Cost Benefits

A second set of basic questions relates to the trade offs between the total social benefits and total social costs of energy use. This is a most difficult area of inquiry, but absolutely essential for rational national planning. Typical of the questions that need much research and study are the following.

What is the factual relationship between energy use and quality of life?

What are the magnitudes of environmental impact from the various energy systems?

How are these impacts related to the range of technical performance of energy devices?

What are the maximum impacts that society is likely to find acceptable?

In relation to public health, how safe is safe enough?

Each of these questions leads to areas of research in economics, sociology, and public health, which are complex to investigate, and in which measures are crude or absent. For these reasons, very little research has been done on these matters. Nevertheless, these questions must be answered, either intuitively or quantitatively, in the process of choosing among technological options and determining national planning for energy systems.

Of particular importance, and difficulty, is the study of long-term low-level environmental impacts. High-level short-term impacts are easily observed and their effects are usually measurable. However, low-level long-term exposures may have the most important cumulative effect, but unfortunately, both observation and measurement are very difficult. For example, the public health effects of trace pollutants can be only crudely guessed at by extrapolation from high-level observations. Yet, government pollution regulations usually pertain to such low-level limits. The trade-off criteria have massive economic and technological significance. In fact, in our zeal to protect the public and the environment, we may be imposing unnecessary constraints on our technical systems that result in serious waste of national resources and impaired delivery of services. We need much more quantitative research on the public effects of long-duration low-level exposures to all types of environmental impacts.

Optional Energy Uses

Another category of social choice relates to the uses of energy. Once the allocation of energy has been made to our essential functional needs, our society provides many options for energy use – recreation, environmental conditioning, communication, and entertainment. The automobile vacation tour, the power-boat cruise, airplane touring, all are examples of nonessential energy consumption freely chosen for purposes associated with individual life styles. Social constraints, economic or regulatory, can be applied to such uses. However, this would represent societal intervention for the purpose of restricting individual choice, and therefore requires a most careful balancing of societal values.

Missing Links

In summary, although R&D programs should not be expected to solve our present energy system problems, they are essential to provide us with the variety of future technological options that our society will obviously need. Further, we are woefully lacking the most elementary trade-off information needed to balance societal benefits and costs in the decisions we must continuously make. And, finally, near-term planning of our national energy systems cannot be optimally conducted without a perception of the long-term R&D possibilities and their potential relationships to existing systems. This calls for a complete technology assessment of our energy systems, present and future – a most complex undertaking because of the pervasive role of energy in our society. As yet, only the most rudimentary steps have been taken toward such an assessment.

Fostering Scientific Talent

Professor Arnold Ross, Chairman of The Ohio State University Mathematics Department, has been working with gifted youth as an avocation for many years. He is deeply distressed by a conviction that the full capabilities of countless talented young people will never be realized for lack of stimulation. Further, he believes that talent abounds among the rich and poor alike, and that the disadvantaged gifted, in particular, should be identified at an early age and their abilities nurtured.

Translating concerns into action, Dr. Ross has directed programs for gifted high-school students under National Science Foundation auspices for the past 14 summers. He served on NSF's Advisory Committee for Science Education and was chairman of the Committee on Undergraduate Education of the National Research Council.

In this paper, he points out that we are on the threshold of a far more sophisticated scientific era than we have ever known, that countries other than the U.S. are doing imaginative things to find and stimulate young talent, and that the U.S. had better do likewise so that the nation will be prepared for both today's problems and the far tougher ones ahead.

ON THE LOGISTICS OF TALENT
by Arnold E. Ross

A New Age

When we speak of current crises, we think of our economic, social, and political problems. When we are concerned with natural resources, we think of sources of materials, sources of food, or sources of fuel, but never, or hardly ever, of the resources of young talent. No other source of our wealth and well-being has been so much taken for granted or so little understood. No other obligation has been left so much to chance as the prospecting for human talent and the development and even the utilization of this talent.

The technological world in which we live is entering a new phase, in which only the most imaginative and astute use of scientific methods will overcome the complex problems facing society. In this new age, our capacity to discover, develop, and utilize human talent effectively will determine the future of our nation. Any nation which fails to understand the problems of the logistics of talent and to utilize this understanding through imaginative and forceful action is heading for disaster. The excuse that it had been difficult to reach our youth will sound very weak and unconvincing when we begin reaping the sad harvest of continued neglect.

From One Generation to the Next

Concern over talent search is a very natural preoccupation. Every thoughtful professional, sooner or later, faces the problem of transmitting his own dedication and mastery to the next generation. Ideally he seeks out those members of the oncoming generation whose talents match his own and whose drive and determination hold promise of success.

The social mechanisms which bring together the young aspirants and the seasoned veterans have varied greatly. The family has often provided an opportunity for direct contact with worthwhile senior practitioners to stimulate youthful interests; or, at least, the family often could and did provide moral support for its younger members in their efforts which, not infrequently, led to changes in their social and economic status.

Opportunities for intellectual awakening have varied from country to country.

Hungary became known for its production of mathematicians for its own universities as well as for the world at large. One need mention but a few names, such as George Pólya, Gabor Szego, John von Newmann, Theodor von Kármán, Paul Erdos, and Paul Turán, to be forcefully reminded of this fact. Regardless of the role played by the

remarkable native gifts of the Hungarian mathematicians themselves, we know that the keen interest displayed by the University of Budapest's mathematical community in ferreting out young talent through its now very famous school journal "Mathematikai Lapok", and in helping such young talent to come to fruition, did play a vital role in this flowering of high achievement.

Belgium for a long period was known as a producer and an exporter of top-notch engineers trained at its universities in the spirit of the Ecole Polytechnique of Paris. The latter, established by the Convention with Napoleon's encouragement and directed at the outset by such distinguished scientists as Gaspard Monge and Jean-Baptiste-Joseph Fourier, is still an outstanding center for the training of the engineering elite in France.

One can easily continue this catalogue of countries and academic centers, delineating their various contributions to the discovery and development of the scientific potential of young people. Such issues form a most interesting chapter in the intellectual and economic history of our society. We shall not, however, dwell upon this enticing chapter of history any more than is needed to provide us with a perspective for a searching look at the growing importance for *any* nation of the discovery, development, and effective utilization of its scientific and technical talent. It is *the awareness of talent as a natural resource of vital importance to national well-being* that is the chief concern of this discussion.

Talent Migration

We have had opportunities to observe and hopefully to benefit from some sobering examples of the effects of talent migration. For example, the U.S. owes much of its technological prowess around the turn of the century to a long list of gifted immigrants such as Charles Steinmetz, Michael Pupin, etc., attracted to our shores. We owe an even more dramatic debt to the talented newcomers for our dominant technological and scientific position at the time of the second World War and in the decades following it. On the other hand, we have seen the adverse effect of an outflow of talent the so-called "brain drain" - and the alarm which it causes in the countries affected.

In the past, we were very fortunate in our ability to attract the talented of the world to our country. We are now reluctant to accept the implications of the fact that today this flow of talent has slowed down and is not adequate to enable us to maintain our ranking *vis-à-vis* our competitors. We ourselves, baffled by new economic stresses, are intentionally diminishing the flow to a mere trickle by creating new barriers against the influx of newcomers, however talented they may be.

New Needs

The urgency for responding astutely to the drastic change in our position is increased by the fact that today's technological society demands that an ever-larger proportion of its professionals be capable of imaginative initiative within the realm of their responsibilities, a fact which, as we shall see, has been recognized by those with whom we compete for a position of world leadership.

The need to explore and exploit our native resources of talent is not due solely to the fact that our needs are so very great. We must recognize as well that it would be politically and socially untenable to pursue a course of action which would deny our own able youth the kinds of opportunities which make our accomplished newcomers from abroad so very valuable. Also for social and political reasons, any genuine search for talent must be carried out with the broadest possible social and economic base. This last strategy is also dictated by the fact that the springs of talent are widely dispersed and are no respecters of geographic, social, or economic boundaries.

Nature or Nurture

Some say that talent will out regardless of the odds stacked against it. One should undoubtedly accept the premise that talent thrives on challenges. However, it would be extravagantly irresponsible to urge a national policy which would make no provi-

sion for an early recognition of the very gifted in all walks of life and their encouragement through an opportunity to face significant relevant challenges.

Crisis Versus Foresight

It is not unusual for an open society to attend to its critical problems only under the pressure of crises. We have been no exception. Our periods of comfortable affluence have often induced a euphoric disregard of the handwriting on the wall which, alas, is ever there for those who would read it. At times such disregard brought us to the brink of a major disaster.

Our neglect of mathematics and science in our secondary schools greatly distressed Admiral Nimitz when the Navy was confronted with the need of turning, practically overnight, a large number of intelligent but mathematically illiterate young people into technically competent line officers. The speech by Admiral Nimitz to our academic community expressing his deep concern over this neglect is a matter of record.*

It seems that the need for technological prowess appears most vividly in times of national conflict. Perhaps for that reason one finds much provocative soul searching in the writings of another admiral — Admiral H. G. Rickover.**

It is more difficult to pinpoint dramatically enough the vital effect of the discovery, development, and proper utilization of talent upon our economic position among nations and upon what we like to call the "quality of life". Perhaps one needs the freedom of a science fiction writer such as Isaac Asimov to attempt to do this.*** Asimov's picture of the process of education is not as overdrawn as one would have liked it to be, for many of our sins both of commission and of omission are due to our all too common failure to differentiate between the formal levels of educational certification and the various stages in the development of the individual's creative capacity.

In the Heat of Competition

Research in atomic energy, begun in 1940 under the wartime threat of a comparable effort on the part of our protagonists, produced much basic scientific information. It was a crash effort constituting a response in an atmosphere of crisis. For many years atomic research was associated both in fact and in the popular mind with the atomic bomb. This association proved to be no less disturbing to the uninitiated fellow citizens than to the physicists who created the bomb. Our success, even though it gave cause for anxiety, was interpreted as an indication of our total scientific and technical superiority.

There are reasons to believe that this imbalance in our favor served as the initial impetus for the significant progress made in the USSR to date in the creation of an intensive program of the discovery and development of its own scientific and technical talent. The story of the growth of this program is the story of the foresight, the imagination, and the dedication of three of the USSR's most distinguished scientists, Peter L. Kapitza, A. N. Kolmogorov, and I. M. Gelfand.

Although our reasonably systematic effort and popular preoccupation with rocketry was brought about by the impressive developments in Germany toward the end of the war, we owe much of our later success to the vision of Theodor von Kármán who, as early as 1936, established JPL — the Jet Propulsion Laboratory at Cal Tech — and provided for it an unusually able staff. This foresight notwithstanding, the really massive effort of rocket development did not begin until after the sudden and unexpected appearance of Sputnik in the autumn of 1957.

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*The Association of American Universities, Journal of Proceedings and Addresses of the Forty-Third Annual Conference, October 1941, p. 92, The University of Chicago Press.

**Education and Freedom, E. P. Dutton and Co., Inc., New York, 1959.

***"Profession" in the Nine Tomorrows Tales, Doubleday and Co., Inc., Garden City, New York, 1959.

A Burst of Energy

The impact of Sputnik was very dramatic. It caused much concern about the adequacy of our available pool of scientists and engineers. Material resources were made available for the training of scientists and engineers and for updating their curricula. New resources were allotted to research. Research prospered and the resulting opportunities attracted gifted participants from the world over. Academic programs in science and technology on all levels of sophistication grew in size and scope at an incredible pace. Special efforts to encourage the very young to enter careers in science were made by the National Science Foundation with the enthusiastic support of the scientific community. Our own involvement with the very young began in the summer of 1957. We have shared with our colleagues our soul searching regarding the subleties of this enterprise in two reports – the first one was written in 1960* and the second report but very recently**.

A Change of Heart

With perplexing suddenness, our Nation has lost its interest in developing an unassailably strong position in science and technology. Some attribute this change of heart to the political unrest that blossomed in the late sixties and early seventies.

As a result of this unrest some priorities have been rearranged to give more attention to the education of the economically underprivileged. Here one should observe that in translating social concerns into action many people forget that the education of the very inexperienced is not a trivial problem, and that it calls for much sophisticated know-how in the training of adults* as well as in the training of children**.

Student unrest and disaffection were much in evidence during this very unhappy period. Many young people voiced their disillusionment with the rigidity, impersonality, and lack of relevance of institutions of higher learning. On the other hand, the older citizens by and large withdrew their support because they blamed the schools for the sharp manifestations of student unrest. It appears that on the one hand we must mend our ways and on the other hand we must mend our fences.

Whatever all of us – students, fellow citizens, members of the academic community – may do, we must not forget that we have in fact brought our world to such a high state of complexity that simplistic solutions, however well meant, will lead only to disaster. We have every reason to believe that we are merely at the dawn of the scientific age. With adequate resources of talent and with imaginative utilization of these resources, we have hope of maintaining and even improving our position *vis-à-vis* nature and *vis-à-vis* other nations. If we lack adequate foresight and if we lack the will to act upon it, we are doomed.

Can Friendly Competition be Devastating?

The strong faith which our very gifted colleagues in the USSR have in the future should prove to be contagious. At the time when we proceeded with our very small-scale efforts, our Russian colleagues built a national network of "mathematics and science circles" in which students come into contact with interesting ideas and interesting people. Members of these circles are encouraged to participate in a variety of science competitions ("Olimpiads"), and in particular they are encouraged to compete for a place in Professor Gelfand's Moscow University correspondence school. There 400 mathematicians each year oversee 4000 students. Each member of the staff gets to know rather well the ten students assigned to him. These programs have already affected very significantly both the size and the quality of the mathematics, science, and engineering enrollments in the USSR

*Ross, A. E., "The Shape of Our Tomorrows", American Mathematical Monthly, November 1970, pp. 1002-1007.

**Ross, A. E., Horizons Unlimited. (Preliminary report available in preprint from the author, Dept. of Mathematics, The Ohio State University, Columbus, Ohio 43210.)

universities and technical schools. In the Moscow University alone, fully 25 percent (the top 25 percent!) of students in the Department of Mathematics, Computer Science, and Mechanics are former pupils of the correspondence school.

The large investment of manpower and money in their talent search is an indication that our Russian colleagues feel that if their future is to be secure, it will have to be entrusted to very accomplished people with much sophisticated know-how.

Many of us feel that this last appraisal applies to our own future as well. We hope and pray that we shall do as much and do it at least as well as our dedicated colleagues in the USSR.

At Last, An OTA!

Thirty-five years ago, a Congressional report indicated that the U.S. Congress was ill equipped to make authoritative judgements on the increasing volume of science- and technology-oriented legislation being proposed. It went on to recommend that the Congress establish a technical information office for the Legislative Branch. Conditions weren't ripe, and apparently there was no real standard-bearer at the time, so the idea withered for lack of nourishment.*

Thirty years later, in 1967, a dedicated standard-bearer emerged in the form of the then-Congressman Emilio Q. Daddario. As chairman of the House Subcommittee on Science, Research, and Development, Daddario extolled the need for "technology assessment" to delineate the social consequences of technological applications. He spearheaded the proposal for an Office of Technology Assessment, held two extensive sets of hearings, and backed a number of contract studies and special seminars on the subject.

Daddario did not run for reelection to the 92nd Congress, but his successor to the Subcommittee chairmanship, Representative John W. Davis, along with his chief counsel, Philip B. Yeager, took up the cause for the establishment of an OTA. On February 8, 1972, the House passed H.R. 10243, the Technology Assessment Act of 1972. However, the Senate objected to some of its provisions, so a conference committee met and resolved the differences. On October 5, H.R. 10243 went to the White House for Nixon's signature, and it became Public Law 92-484 shortly thereafter.

*The Conference Report,** reproduced below, gives the substantive part of the compromise version of the bill, including the purposes, structure, staffing, operations, reporting, and funding of the embryonic Office of Technology Assessment.*

TECHNOLOGY ASSESSMENT ACT OF 1972 CONFERENCE REPORT (House Report No. 92-1436)

by G. P. Miller

The committee of conference on the disagreeing votes of the two Houses on the amendment of the Senate to the bill (H.R. 10243) to establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes, having met, after full and free conference, have agreed to recommend and do recommend to their respective Houses as follows:

That the House recede from its disagreement to the amendment of the Senate and agree to the same with an amendment as follows: In lieu of the matter proposed to be inserted by the Senate amendment insert the following:

That this Act may be cited as the "Technology Assessment Act of 1972".

Findings and Declaration of Purpose

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are –

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the

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*Cited by Representative M. L. Esch [Congressional Record, 118 (16): H880, 8 February 1972] in testimony supporting H.R. 10243.

**Congressional Record, 118 (150), H8701-8704, 25 September 1972.

fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) The Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to —

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

Establishment of the Office of Technology Assessment

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities;

(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and

(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:

(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;

(2) the Board; or

(3) the Director, in consultation with the Board.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or

other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where —

(1) to do so would violate security statutes; or

(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

Technology Assessment Board

SEC. 4. (a) The Board shall consist of thirteen members as follows:

(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;*

(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party;* and

(3) the Director, who shall not be a voting member.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses.

Director and Deputy Director

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

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*These appointments were made as SPR went to press on October 17. They are Senators E. M. Keanedy (D., Mass.), E. F. Hollings (D., S. Car.), H. H. Humphrey (D., Minn.), G. Allott (R., Colo.), P. H. Dominick (R., Colo.), R. S. Schweiker (R., Pa.), and Representatives J. W. Davis (D., Ga.), E. Cabell (D., Tex.), M. McCormack (D., Wash.), C. A. Mosher (R., Ohio), C. S. Gubser (R., Calif.), and J. Harvey (R., Mich.).

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrrangement under this Act.

Authority of the Office

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to –

(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory, or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

Establishment of the Technology Assessment Advisory Council

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

(b) The Council, upon request by the Board, shall

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a) (1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

(d) The term of office of each member of the Council appointed under subsection (a) (1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a) (1) more than twice. Terms of the members appointed under subsection (a) (1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

(e) (1) The members of the Council other than those appointed under subsection (a) (1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter I of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

(2) The members of the Council appointed under subsection (a) (1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

Utilization of the Library of Congress

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

Utilization of the General Accounting Office

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by by the Board and the Comptroller General.

Coordination With the National Science Foundation

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to -

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14 (g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

Annual Report

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

Appropriations

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,000,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

And the Senate agree to the same.

George P. Miller,
John W. Davis,
Earle Cabell,
Charles A. Mosher,
Marvin L. Esch,

Managers on the Part of the House.

Howard W. Cannon,
Robert C. Byrd,

Managers on the Part of the Senate.

Current Literature

AFRICA

2575. *Survey on the Scientific and Technical Potential of the Countries of Africa*, Second Edition, Unesco, 1970, 296 pp. (Available from Unipub Inc., Bo. 433, New York, N.Y. 10016. Price: $6.00.)

Consists of an inventory of the scientific and technical research institutions in Africa and a preliminary inventory of African institutions and research workers in the principal disciplines, compiled from information obtained (during 1969-70) through a questionnaire survey covering 40 African countries; the framework of the present survey has been enlarged to include institutions not covered in the 1963-64 survey, i.e., those concerned with oceanography, medical sciences, and economic, social, and human sciences research.

ALASKA PIPELINE

2576. "The Trans-Alaska Pipeline: Statement of Secretary Morton", *Congressional Record*, v. 118, no. 115, 24 July 1972, pp. S11548-11551.

Presents testimony by R.C.B. Morton, Secretary of the Interior, in hearings on the Trans-Alaskan pipeline before the Joint Economic Committee, defending his decision to grant the permit for construction of the pipeline; Morton enumerates the many public hearings on the pipeline, discusses the strict regulations to be put on the oil tankers traveling from Valdez to West Coast ports, describes serious time delays with the Canadian route, and compares the ecological effects of the Canadian and Alaskan routes.

2577. Pedera, D., "Investigating the Environment at Valdez", *Congressional Record*, v. 118, no. 120, 31 July 1972, pp. S12246-12247.

Describes the detailed oceanographic and meteorological research now being conducted by the Alyeska Pipeline Co., which will build and operate the trans-Alaskan pipeline, on the Valdez Arm through which the proposed pipeline will extend; these studies underscore the efforts being made to preserve the environmental quality of the area.

2578. "Alaska Indian Support for Trans-Alaska Pipeline", *Congressional Record*, v. 118, no. 139, 8 September 1972, pp. S14368-14369.

Reprints a resolution passed by the Indian members of the National Council on Indian Opportunity which supports the U.S. Secretary of the Interior's decision to issue the right-of-way permit for the trans-Alaska pipeline as soon as the legal constraints have been removed; the resolution emphasizes that the delay in construction of the pipeline and thus in the production of North Slope oil will delay the flow of funds (assured by the Alaska Native Claims Settlement Act) to Alaska Natives – funds urgently needed to begin the development of job and training opportunities and various economic development activities.

ATMOSPHERIC SCIENCES

2579. Purrett, L. A., "Analyzing the Atmosphere", *Science News*, v. 102, no. 4, July 1972, p. 60.

Discusses the plans of the National Oceanic and Atmospheric Administration meteorologists to set up a global system of stations to monitor carbon dioxide, carbon monoxide, ozone, dust from agricultural activity and volcanism, and other trace constituents of the atmosphere; the project is called Geophysical Monitoring for Climatic Change, and will be the first effort of its kind; the Mauna Loa Observatory will be the main station, with other stations being planned for Barrow, Alaska, and the South Pole; describes other monitoring sites being considered.

2580. *World Weather Program, Plan for Fiscal Year 1973* (Available from U.S. Government Printing Office, Washington, D. C. 20402. Price: 50 cents.)

Presents details of U.S. plans for participation in the World Weather Program (WWP); major efforts include: improvements in the current operational satellite systems; development of a next-generation satellite system; establishment of an expanded atmospheric monitoring capability; increased computer-processing capacity; and assistance to the meteorological services of developing nations.

2581. *The Federal Plan for Meteorological Services and Supporting Research, FY 1973*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, January 1972, 70 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents.)

Presents a special analysis on weather disaster warnings, in response to a growing interest and accelerated efforts to meet an expanding need; summarizes the fiscal data for the total services and functions performed; describes the Meteorological Services -- Basic and Specialized -- along with the operational and research programs planned for FY 1973; discusses the program changes planned for FY 1973, and presents a detailed description of the meteorological satellite program.

2582. *Project Stormfury — 1972*, 14 pp. (Available from Office of Public Affairs, National Oceanographic and Atmospheric Administration, Rockville, Md. 20852.)

Describes the 1972 hurricane seeding plans for Project Stormfury, a joint Department of Commerce/Department of Defense program of scientific experiments to explore the nature of tropical storms and hurricanes, and to investigate the possibility of modifying them; the major goal for 1972 is to confirm the promising results of the experiments conducted in 1969; the aircraft and flying procedures used in seeding hurricanes are also described, along with the 1969 and 1971 experiments.

2583. Abzug, B., "Introduction of Legislation to Prohibit Weather Modification for Military Purposes", *Congressional Record*, v. 118, no. 128, 9 August 1972, pp. H7447-7449.

Reprints the text of bill H.R. 16255, prohibiting the U.S. from engaging in weather modification activities for military purposes; presents a statement and an article describing the dangers of cloud seeding, and condemns the use of such activities as weapons of war.

2584. Pollack, H., "International Aspects of Weather Modification", *U.S. Department of State Bulletin*, v. 67, no. 1730, 21 August 1972, pp. 212-214.

Recounts the interest and actions of the Department of State in the past regarding policy on weather modification; raises questions concerning Senate Resolution 281, which proposes an international treaty prohibiting the use of any environmental or geophysical modification activity as a weapon of war, and recommends that the resolution not be adopted, on the grounds that "there is, at present, too much uncertainty about essential facts and that the factual basis itself is insufficient to make possible any fundamental decisions on whether a treaty dealing with military aspects is feasible and desirable".

2585. Lambright, W. H., "Notes on Weather Modification and Public Policy", *sppsg*, v. 3, no. 7, August-September 1972, p. 4-10.

Examines the many aspects of weather modification (particularly cloud seeding), the issues involved, and the state of development of this technology; describes concerns of scientists over the possible, as yet unknown risks, and presents their views: (1) that cloud seeding is not ready for operational use, (2) that they are uncertain as to its potential for triggering large weather effects, and (3) that further research and development is required; describes some beneficial uses of cloud seeding (e.g., to dissipate fog, diminish the intensity of hurricanes, and bring water to arid areas); discusses the lack of clearcut controls, the variability of state and local laws, and the probability of continued seeding on ever-larger scales, and stresses the increasing need for Federal regulation of weather modification.

2586. "Weather Modification Warfare", *Inside R&D*, v. 1, no. 18, 2 August 1972, p. 2.

Describes increasing concern over the use of weather as an offensive weapon and mounting fears that a "weapons race" could develop in this field; points out that both the Soviets and the U.S. have fairly large weather-control research programs; notes the U.S. Senate's approval (in late July) of an amendment to the weapons bill which cut off DOD funds for any use of rainmaking or creation of forest fires

as weapons of war; calls for immediate agreements with the Soviet Union and China to curb such "weather weapons", with provisions for continuation of legitimate nonmilitary weather research.

2587. Shapley, D., "Science Officials Bow to Military on Weather Modification", *Science*, v. 177, no. 4047, 4 August 1972, p. 411.

Cites statements made at Senate hearings on weather modification, held for the primary purpose of reviewing recent allegations of the U.S.'s rainmaking for military purposes in Indochina and their implications for foreign policy and world science; notes the appearance of only one minor official as a witness for DOD, the complete unresponsiveness of this witness, and the claims of other witnesses that they had no knowledge of the activities in question; also considered at the hearings was Senator Pell's proposed draft treaty on geophysical warfare, but no specific action was taken, and some scientists fear that DOD's apparent prerogatives on weather technology will interfere with international cooperation on research in this area.

AUSTRALIA

2588. Robertson, R. N., "Scientists and Government in Australia", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 187-196.

Describes the administration of government science in Australia and the mechanism for conveying advice on scientific matters to the government; discusses the influence of the scientific community on government science policy; suggests the involvement of scientists in discussions of means to optimize channeling of advice to government, since they are the most knowledgeable about research and probably the most capable of predicting the developments that may result from it; recommends examination by independent scientists of science policies proposed by government departments, since scientists in government employ are subject to considerable restrictions on their freedom of discussion.

2589. "Australian and New Zealand Scientists Meet", *Nature*, v. 238, no. 5365, 25 August 1972, pp. 425-426.

Reports on the discussions at the 44th congress of the Australian and New Zealand Association for the Advancement of Science, which focused chiefly on the organization of science in Australia (including the support of R&D), the development of nuclear energy, and the export of minerals such as uranium; other topics considered included population growth, housing, and pollution.

2590. "Committee Assembled", *Nature*, v. 239, no. 5368, 15 September 1972, p. 126.

Announces that the Australian government has at last settled the composition of the Advisory Committee on Science and Technology which is intended to give advice on the planning of a strategy for Australian R&D; describes Australian industry's discontent with the Commonwealth Scientific and Industrial Research Organization, still the dominant force in Australian R&D, and questions concerning the extent to which the Advisory Committee will reflect that discontent in its recommendations; lists the membership of the 11-man Committee, 6 of whom are from industry, and 5 from universities.

BIOLOGICAL SCIENCES

2591. Carson, H. L., "Evolutionary Biology: Its Value to Society", *BioScience*, v. 22, no. 6, June 1972, pp. 349-352.

Describes society's attitude toward evolutionary science, and examines the social relevancy of basic science; reviews the development of evolutionary science and the myths it has dispelled about human origin, the nature of the individual, and differences in race; discusses specific areas of problem solving behind which such research lies, for instance, problems related to overpopulation, food supply, public health, pest control, radiation effects, and the urban environment.

2592. Holden, C., "World Ethics Body Proposed", *Science*, v. 177, no. 4055, 29 September 1972, p. 1174.

Describes plans for an international, nongovernmental commission to explore the moral and social issues raised by new and forthcoming developments in biology and medicine, as proposed by the Council for International Organizations of Medical Sciences; the new commission would be made up of equal parts biologists and medical people, humanists and social scientists, and theologians; in addition to coping with ethical problems, the commission might also influence policymakers in determining biomedical research priorities.

BRAZIL

2593. "The Course of Science in Brazil", *International Science Notes*, no. 28, September 1972, pp. 5-6.

Notes the greater attention and financial support being devoted to science and technology by the Brazilian Government; outlines the priorities for 1972-74 set forth in the *Basic Plan for Scientific and Technological Development (PBDCT)* established for Brazil: incorporation of new technologies; development of intensive technology industry; consolidation of infrastructure technology (relating to electronics, power, petroleum, transportation, and communications); intensive programs of agricultural research; technology transfer; industry-university coordination; and strengthening the technological infrastructure; describes Brazil's plans for nuclear energy and space research and for creation of a national system for collecting and disseminating scientific information available in Brazil and abroad.

BUDGET FOR SCIENCE AND TECHNOLOGY

2594. "Federal R&D Funding Continues to Rise", *Science Resources Studies Highlights*, National Science Foundation Report NSF 72-314, 11 August 1972, 4 pp.

Presents data clearly establishing an upward trend since 1970 in Federal R&D support; increases are expected to be from $15.5 billion in FY 1971 to $16.8 billion in FY 1972, to an all time high of $17.8 billion in FY 1973; presents graphs and tables depicting this R&D funding scheme since the early 1960's, and lists federal funding according to governmental department, field, performer, and state.

2595. "Oceanography Funds: Murky Future", *Washington Science Trends*, v. 28, no. 13, 3 July 1972, p. 73.

Discusses the funding prospects for oceanography in the immediate and long-term future; according to the Office of Management and Budget, in the short term, (1) civilian public oceanographic spending will be generally limited to research, mapping, monitoring, and prediction; (2) marine resource development is regarded as the province of private enterprise, and Federal funding in that area is unlikely; (3) Government's role will be limited to aid in closing gaps in basic knowledge, and in conservation; (4) all programs proposed will have to be justified; for the long term, funding prospects should improve as public awareness of the role of oceanography in solving national problems increases and the relevance of spending becomes more apparent.

CANADA

2596. Herzberg, G., "Bureaucracy and the Republic of Science", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 105-110.

Criticizes the report of Canada's Senate Special Committee on Science Policy [*SPR* 5(1): 1775] (a) charging that it presents a biased assessment of Canadian science since it emphasizes past failures but minimizes the successes; (b) challenging the Committee's view that a coherent science policy will overcome all difficulties; (c) questioning the Committee's basis for its contention that Canada spends an inordinate amount of money on basic research; and (d) contending that major science programs are of questionable value, pointing out that most progress in science has been made through small scientific investigations; emphasizes scientists' need for freedom from bureaucratic control, and warns that "bureaucracy is a far greater danger to Canada and to science than the republic of science".

2597. "Call for End to the Haldane Principle in Canada", *Nature*, v. 238, no. 5363, 11 August 1972, pp. 305-306.

Reports the views held by critics of Canadian science policy, namely, that the country's industry lacks an adequate technological base, that too much of the national research effort is carried out in government laboratories, and that there is a lack of synergism between the universities, industry, and government; describes efforts by these critics to force changes in the National Research Council of Canada, the hub of the Canadian Government's support of science and technology; points out that the most likely change in the council's structure would be to split the university granting functions away from the NRC laboratory operation, and speculates as to the possible effects of such a change.

2598. Berlinguet, L., "An Urgent Need: A Science Policy for Quebec" (in French), *Science Forum*, v. 5, no. 4, August 1972, pp. 13-16.

Berlinguet, Vice President for Research at Quebec University, President of the National Institute of Scientific Research, and past President of the Association of Scientists, Engineers, and Technologists of Canada, argues for the prompt establishment of a science policy for Quebec to supplement the science policy being established by the Canadian Government; discusses the various university and industrial research establishments of Quebec, which spent almost $200 million for R&D in 1970-71; describes the structure and functions of Quebec's Secretariat of Science Policy, Council of Science Policy, and Ministries of Industry and Commerce, Lands and Forests, Agriculture, Social Affairs, and Education.

2599. Charles, M. E., and Mackay, D., "Innovation in Industry and Jobs for Scientists: Two Problems, One Solution", *Science Forum*, v. 5, no. 4, August 1972, pp. 8-11.

Describes concerns over the future of Canadian secondary industry, and the need for improvement in the industry's capability for innovation; delineates the links comprising the innovative process (e.g., basic research, market survey, financing, production, and marketing), and the types of support for innovation needed by various categories of Canadian industry; urges government support where needed, and special incentives for Canadian-owned companies; emphasizes that "any science policy for innovation in Canadian industry will require the co-operation of government, industry, and universities and the involvement of young graduates".

CHINA

2600. Orleans, L. A., "How the Chinese Scientist Survives", *Science*, v. 177, no. 4052, 8 September 1972, pp. 864-865.

Describes the present position of Chinese scientists, and explains their attitudes toward the "assaults" imposed upon them during the cultural revolution: (1) the scientists know their worth and importance to the regime, and attacks against them are balanced by official statements emphasizing the need for the scientists' expertise; (2) they are aware that these attacks are being utilized by the regime to increase the self-confidence of the masses to achieve the goal of true modernization, which Mao believes is not possible unless the general level of the workers and peasants is raised to a reasonable level of skill and technical common sense; points out that scientists are sent for only short periods to the farm or factory (whichever is most relevant to their field) to pursue their specialization in terms of specific needs of the economy; discusses the declining role of the Peoples Liberation Army in science.

COMMUNICATIONS

2601. Morgan, R. P., and Singh, J. P., *A Guide to the Literature on Application of Communications Satellites to Educational Development, an ERIC Paper*, Center for Development Technology, Washington University, St. Louis, Mo., April 1972, 19 pp. (Available from ERIC Document Reproduction Service, P.O. Drawer O, Bethesda, Md. 20014. Price: Microfiche, 65 cents; Hardcopy, $3.29.)

Provides an introduction to three subjects: satellite technology, the nontechnological aspects (economic, social, organizational, political, and legal factors), and

the educational and developmental uses of satellites; presents a guide to selected literature on these three subject areas, as well as to organizations with an interest in educational satellite utilization; includes a bibliography.

2602. Wilson, R. C., "Communications", *Vital Speeches of the Day*, v. 38, no. 20, 1 August 1972, pp. 638-640.

Contends that communications technology is essential to U.S. interests on social, economic, and military grounds, and that the U.S. is losing its world leadership in the communications industry because of lack of government support; describes the U.S.'s competitive position in the world, and recommends actions to help the U.S. regain its competitive edge: establishment of telecommunications technology as a national priority; increased government spending for communications R&D; establishment of a modern military command network; and establishment of a joint Government/industry committee to support U.S. telecommunications leadership, and assure equality of opportunity for U.S. industry.

2603. Goldmark, P. C., "Communication and the Community", *Scientific American*, v. 227, no. 3, September 1972, pp. 143-150.

Discusses the potential of various telecommunications systems, and suggests a number of ways in which new applications of communication technology could make communication more useful to people as individuals or to entire communities [*SPR* 4(3): 955]; describes possible applications in five fields: municipal administration, education, health care, pollution control, and transportation.

2604. Goldmark, P. C., "The New Rural Society through Communication Technology", *Research Management*, v. 15, no. 4, July 1972, pp. 14-25.

Describes the World exponential growth curves for life expectancy, population, and published books; discusses the dangers of exponential growth, viz., depletion of resources and the environment; emphasizes the need for actions to alter the curves, for example, by reversing the trend towards large population concentrations; suggests that modern communications could be the means of achieving this reversal, and describes studies directed toward establishing the "New Rural Society" with the aid of modern communications.

2605. McDonald, J., "Getting Our Communication Satellite Off the Ground", *Fortune*, v. 25, no. 7, July 1972, pp. 66-69, 118, 120, 122, 124, 126.

Discusses the impact of the Federal Communications Commission's long-awaited decision authorizing the operation of satellites by several organizations, while placing important restrictions on some of the applicants, including the American Telephone & Telegraph Corp. and Comsat; describes the effects of the FCC's decision on network TV and cable-television operations, and the debates concerning the formation of a coalition between applicants for a satellite system such as Western Union, Hughes Aircraft Co., and General Telephone & Electronics; describes prices and facilities of various systems proposed.

2606. "High-Frequency Communications Satellite", *Washington Science Trends*, v. 28, no. 20, 21 August 1972, p. 117.

Announces that researchers are being invited to take part in information transfer or networking studies using an experimental communications satellite being developed by NASA and Canada for a 1975 launch date; the investigations will involve techniques for TV services to small villages, including community TV and audio broadcast, relay of signals from TV cameras in remote locations, two-way voice communications, and data linking and distribution; extensive participation in the program by research groups and individual experimenters is expected, although no NASA funds will be provided. (For further information, contact NASA, Washington, D.C. 20546, Attn: S. W. Fordyce, Code ECF.)

2607. "Maritime Satellite Pushed Abroad", *Aviation Week & Space Technology*, v. 97, no. 7, 14 August 1972, pp. 47, 49.

Discusses the eagerness of maritime nations to proceed with plans for a communications satellite system to serve ship operators (mare-sat), and examines the reasons for the hesitancy with which the U.S.'s Office of Telecommunications Policy is approaching the plan; describes the complex issues facing OTP in reaching a mare-sat policy decision, and the most worrisome problem for U.S. policy makers, viz., that of working out a permanent arrangement for ownership and

operation of a joint aerosat/mare-sat system with two different classes of users, and several dozen countries.

2608. "Jostling for Space in Orbit", *Nature*, v. 238, no. 5358, 7 July 1972, p. 8.
Discusses the reasons for the Federal Communications Commission's delay in permitting the development of domestic satellite communications systems in the U.S.; reports that the FCC will now allow all applicants able to demonstrate their financial and technical ability to run a satellite system, and the need for the proposed service, to proceed with their projects; however, the services of American Telephone and Telegraph Co. and the Communications Satellite Corp. will be largely restricted.

COMPUTERS

2609. *Expanded Research Program Relative to a National Science Computer Network (Description and Guidelines for Proposal Preparation)*, National Science Foundation, Booklet NSF 72-16, 1972, 13 pp. (Available from National Science Foundation, Washington, D.C. 20550.)
Presents details of the research program and outlines, as indicative of the scope, a few of the research, exploratory, and development efforts that might be needed to realize the potential of a National Science Computer Network, for example, in such areas as organization, user functions, network technology, and evaluative activities; emphasis will be placed on concept definitions and the derivation of guidelines; this announcement is not intended to encourage, at this time, proposals for the implementation of the trial network; the Foundation suggests, instead, a series of discussions and preliminary proposals to permit the Foundation to gage the user community's sense of direction, interests, and requirements.

CZECHOSLOVAKIA

2610. Müller, K., and Nejedly, R., "The Regional Distribution of Research and Development (A Note)", *Research Policy*, v. 1, no. 3, July 1972, pp. 320-328.
Analyzes the regional distribution of R&D potential within Czechoslovakia, and the extent of its influence on the social and economic interregional balance; statistical analysis indicates that there is no correlation of regional distribution of R&D potential with distribution of economic activities; however, a closer analysis, considering the industrial structure, reveals a more significant relationship between economic factors and R&D potential, particularly in research-oriented industries; different aspects of the problem in the areas of basic and industrial research are also examined.

DEVELOPING COUNTRIES

2611. *The Brain Drain from Five Developing Countries: Cameroon-Colombia-Lebanon-The Philippines-Trinidad and Tobago*, UNITAR Research Reports, no. 5, 1971, 173 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)
Presents a synthesis of the five-country studies, which deals with (1) the emigration of professional and skilled manpower -- general patterns, destinations, and causes; (2) factors motivating this migration (political, administrative, socio-economic, and educational); (3) the losses (in investment for education and training as well as in potential output) and gains from the outflow (e.g., science and technology transfer); and (4) possible influence of the private sector; provides summaries of studies in the individual countries; offers suggestions and recommendations for practical action at the national and international levels.

2612. *Scientific and Technical Information for Developing Countries*, a Report of an Ad Hoc Advisory Panel of the Board on Science and Technology for International Development, April 1972, 80 pp. (Available from the Board on Science and Technology for International Development, Office of the Foreign Secretary, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)
Discusses the need for greater and more effective use of scientific and technical

information in existing and proposed developmental efforts, and offers a rationale for increased technical assistance along this line; reviews the functions of the information-transfer process and the necessary components of an information infrastructure; considers specifically the information requirements of developing countries in priority areas of industrial technology, natural resources, and the scientific and technical disciplines; presents recommendations on assistance in scientific and technical information, encompassing the areas of policy, priorities, programming, administration, and suggested action programs.

2613. Sola Pool, I. de, *Communications, Computers and Automation for Development*, UNITAR Research Reports, no. 6, 1971. 61 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Offers futuristic speculations on the application of communications technology and computers to development, together with some reflections on the limitations and advantages of automation in developing countries.

2614. "Licensing Advice for Developing Countries", *Chemical & Engineering News*, v. 50, no. 27, 3 July 1972, pp. 10-11.

Cites suggestions offered to developing countries wishing to establish a profitable chemical industry, which stress the need for more emphasis on licensing technology from small- to medium-size companies; explains why such licensing actions would be beneficial to, less expensive for, and easier and faster to consumate by developing countries, and discusses the reasons for these countries' failure to take advantage of such procedures.

2615. Moravcsik, M. J., "Physics in the Developing Countries", *Physics Today*, v. 25, no. 9, September 1972, pp. 40, 42-43, 46-47.

Contends that scientific isolation from the rest of the world and the lack of adequately trained manpower are the two main problems facing the less developed countries; proposes some programs with which physicists in the more advanced countries can mitigate these problems and thus contribute to the scientific emergence of the developing nations; identifies target areas for cooperation within the international physics community, such as education, industrial research, personnel exchange, written communication channels.

ECONOMICS AND SCIENCE

2616. Clark, N. G., "Science, Technology, and Regional Economic Development", *Research Policy*, v. 1, no. 3, July 1972, pp. 296-319.

Stresses the dependence of a firm's competitive position on its capacity for innovation; examines the hypothesis that regional factors which inhibit this capacity (e.g., lack of centralized scientific services and thus lack of access to new technologies) may put firms in those regions at a competitive disadvantage; discusses the advantages accruing to firms located near centers of scientific and technological activity (academic bodies and government laboratories); theorizes that such factors may be major contributors to intensification of social and economic problems in underdeveloped regions.

2617. "Progressive Firms Pursuing Innovation", *Inside R&D*, v. 1, no. 23, 6 September 1972, p. 3.

Reports a trend among progressive firms toward seeking ways to capitalize on new ideas, inventions, and technology developed outside the firms – that is, viewing technology as a product to be sold, licensed, or developed to the point where it creates profits; points to a growing list of firms who have set up separate corporate entities to investigate, develop, and commercialize such innovations in areas not directly related to the firms traditional product lines; describes a major implication of this trend: with technology becoming a commodity to be bought and sold on the world market, only those nations without capital will be unable to fill gaps in their technology, and business leadership will go to those nations best able to turn technology into profitable products.

2618. Lamont, L. M., "Entrepreneurship, Technology, and the University", *R&D Management*, v. 2, no. 3, June 1972, pp. 119-124.

Describes the impact of small-technology-based enterprises ("spin-off") on regional

economic development, and examines the role of the university as the source of new technology and entrepreneurs; presents guidelines for improving the academic entrepreneur's corporate performance, offers suggestions to aid the university in facilitating the entrepreneurship process, and briefly describes the future prospects for academic entrepreneurship.

2619. *A Price Index for Deflation of Academic R&D Expenditures*, National Science Foundation Report NSF 72-310, May 1972, 30 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20550. Price: 25 cents.)

Presents the results of a study on price trends affecting R&D activities at academic institutions, revealing that price inflation has accounted for a 50% increase in direct costs of academic R&D for period ending June 1971 [*SPR* 4(4): 1403]; discusses price index measurement concepts, methodology, and limitations; Part I of the report provides a brief overview, while Parts II, III, and IV are more technically oriented.

2620. "Common Market Leaders Encourage Technological Development by Medium Sized Companies", *Inside R&D*, v. 1, no. 17, 27 July 1972, p. 3.

Describes plans to offer direct financial aid to medium sized companies with the aim of building a broader base of technologically talented companies in Common Market countries, where these talents now reside chiefly in corporate giants; plans call for loans at 3% interest (repayable only if the project fails) to firms from CM companies which cooperate on approved projects, with the loans to cover at least 70% of the cost, but maybe as much as 100%; CM officials claim that the idea is to promote projects with social or environmental qualities, but the consensus is that competitive factors, with the U.S. or other countries, are sure to be considered.

2621. *National Planning Association Publications*, 1972, 24 pp. (Available from National Planning Association, 1606 New Hampshire Ave., N.W., Washington, D.C. 20009.)

Presents an annotated listing of recent NPA publications on such topics as economics, marine resource development, manpower, policy formation, and a selected backlist (not annotated) including publications on, for example, technology transfer, technical cooperation in Latin America, and the economic aspects of nuclear energy.

2622. Khol, R., "Victory Through Brainpower", *Machine Design*, v. 44, no. 23, 21 September 1972, pp. 110-121.

Discusses the declining position of the U.S. in global trade, which many attribute to a lagging technology and describes the role of technology in maintaining competitive strength; stresses the need for a concerted effort to extend U.S. technology beyond that of its foreign competitors, and explores the question as to what types of research will provide the desired technological edge; suggests that close-in (not exotic) short-term R&D work offers the greatest potential for significant returns, and suggestes areas wherein such research should be encouraged; concludes that Government funds will do the most good if used to subsidize R&D in "endangered industries", rather than for endless studies on the mechanisms of technology transfer, and that subsidized R&D could end up costing less than quotas or tariff protection.

2623. "Growing Competition Faces U.S.", *Aviation Week & Space Technology*, v. 97, no. 2, 10 July 1972, pp. 12-15.

Examines the present status of the international aerospace industry; compares aerospace export sales among the leading nations such as the U.S., France, Japan, and the Soviet Union; predicts a reduction in U.S. aerospace exports over the next few years due to the decline of significant technological leadership, the strongly aggressive international competition, and the crippling Congressional limitations.

2624. Hotz, R., "The Export Problem", *Aviation Week & Space Technology*, v. 97, no. 3, 17 July 1972, p. 9.

Contends that a declining trend in aerospace exports, due to lack of a consistent and effective policy within the many facets of the U.S. Government, lack of a consistent R&D policy, and increased international competition, is responsible for the U.S. trade deficit; suggests several actions to remedy the situation, such as the establishment of the export of high-technology products as a national goal, and

forcing all federal agencies to conform to a uniform code and policy on ad .nced-technology exports.

2625. "Administration Relaxes Stance on Selling U.S. Technology to the Soviets", *Inside R&D*, v. 1, no. 17, 27 July 1972, p. 4.

Describes Occidental Petroleum's (Los Angeles, Cal.) potential trade deal with the Soviet Union, which would involve exploitation and production of gas and oil using Occidental's technology; points out that most of the Soviet business is going to European firms (especially those of West Germany); views the apparent approval of Occidental's deal by the U.S. Office of Export Control as a move needed to ensure a share of the Soviet market for U.S. firms.

EDUCATION

2626. Aldrich, J. L., and Kormondy, E. J., "Environmental Education: Academia's Response", *BioScience*, v. 22, no. 6, June 1972, pp. 353-354.

Discusses the need for greater understanding of the problems and opportunities that exist in environmental education, particularly as they relate to priorities for action within the next few years; presents a set of questions designed to aid in the assessment of interdisciplinary environmental education programs and to bring to light those aspects of institutional plans and achievements not adequately discussed in the generally available literature.

2627. Culliton, B. J., "AMA: Graduate Medical Education Plan OK'd, Other Issues Confronted", *Science*, v. 177, no. 4043, 7 July 1972, pp. 40-41.

Discusses the many social and internal stresses confronting the American Medical Association: for example, emergence of doctors' unions, pressures for national health insurance, and suggestions for "peer review" of the quality and cost of health care; describes demands for changes in the patterns of graduate medical education, and AMA's adoption of a plan whereby "all the organizations and institutions that can legitimately expect to have some input in graduate medical education will be represented".

2628. *Ocean Engineering for Undergraduates*, University of Rhode Island Pamphlet, 1972, 4 pp. (Available from Marine Advisory Service, University of Rhode Island, Narragansett Bay Campus, Narragansett, R.I. 02882.)

Describes the recently approved program which will enable students to graduate with an ocean engineering option, and to take the joint ocean and mechanical or chemical engineering program in their senior year; points to the growing interest in hiring engineers with B.Sc. degrees plus ocean-related skills, and the opportunities for careers in management of near-shore areas of the U.S.

2629. Slonim, G. M., "The 'Humanities of the Sea' ", *Vital Speeches of the Day*, v. 38, no. 22, 1 September 1972, pp. 674-676.

Describes the importance of oceanic education to society and to the environment, and what the components of an oceanic education program should be if it is to become an integral element of all liberal education; discusses the potential of the oceans, and points out that "there is a growing realization that man's future is dependent on his knowledge of the seas, and his understanding of their dynamic relationship to his society".

2630. Ritterbush, P. C. (Ed.), *Talent Waste: How Institutions of Learning Misdirect Human Resources*, Acropolis Books, Ltd., Washington, D.C. 20009. ($3.95)

Presents a collection of articles which for the most part call for reform in institutions of learning; notably pertinent to science and education policies are articles by E. M. Kennedy ("Reemploying Technical Resources"), S. Horn ("Organizing and Institutional Response to Future Manpower Needs"), and W. J. McGill ("The Response of the University to Changing Career Patterns"); Senator Kennedy stresses the need to redirect technical talents toward U.S. priority problems in such areas as health, housing, education, transportation, and energy resources; while Horn and McGill highlight the need for educational institutions to adapt their curricula to today's changing manpower needs and career opportunities.

2631. "Changes in Graduate Programs in Science and Engineering 1970-72 and 1972-74", *Science Resources Studies Highlights*, National Science Foundation Report NSF 72-311, 21 July 1972, 4 pp.

Presents findings of a recent survey which indicate that little expansion in graduate programs in science and engineering occurred in the past 2 years, and even less is expected in the next 2 years; during 1970-72 the ratio of net additions in doctoral programs to existing programs was 1 to 26, and current plans indicate that for 1972-74 this rate of growth will cut at least in half (to 1 to 66); presents tables and graphs showing changes in number of programs in science and engineering fields for various universities.

2632. Wolfle, D., *The Home of Science: The Role of the University*, Twelfth of a Series of Profiles Sponsored by The Carnegie Commission on Higher Education. McGraw-Hill Book Co., 1972, 202 pp. (Price: $6.95.)

Traces the development of scientific endeavor in the U.S., reviews the circumstances which led to the development of the American university, and describes the impacts on the traditional college, on the fields of learning, and on the patterns of financial support; describes the financial support provided to higher education by the Federal Government, considers Government-university-science relations, and discusses the trends, policies, and problems in the area of financial support.

2633. "Federal Support to Universities and Colleges Reaches $3.5 Billion in FY 1971", *Science Resources Studies Highlights*, National Science Foundation Report NSF 72-316, 22 September 1972, 4 pp.

Presents statistics on Federal funding for academic R&D in 1971, which reveal increases of 8% in Federal funds to universities and colleges, 7% in total academic science activities, and 7% in Federal obligations for academic R&D activities (with the life sciences constituting 48% of the total obligations); lists total Federal obligations to the 100 universities and colleges receiving the largest amounts.

2634. *The Fourth Revolution; Instructional Technology in Higher Education*, A Report and Recommendations by The Carnegie Commission on Higher Education, McGraw-Hill Book Co., 1972, 106 pp. ($1.95)

Identifies the revolutions in education, the latest of which is portended by developments in electronics, notably those involving radio, television, tape recorder, and computer; describes the impact of the information revolution on libraries, and the impact of instructional technology on faculty and students; examines the extent of the availability and usage of instructional technology, and offers recommendations as to directions for new effort to advance the time when currently available technologies will be fully realized; includes an appendix which provides limited cost estimates for various forms of instructional technology, emphasizing that these must be regarded only as examples.

2635. "Congressman Hansen of Idaho Introduces Bill to Establish Council on Educational Technology", *Congressional Record*, v. 118, no. 140, 11 September 1972, pp. H8206-8208.

Presents the text of bill H.R. 16572 to establish a Council on Educational Technology which would be charged with coordinating Federal agencies' actions and policies affecting educational technology (both in-house and external programs); in addition, the Council would be responsible for bringing together representatives of various educational users of technology for the identification and articulation of common needs and concerns, and would serve to foster communications between educational technology users and manufacturers and distributers of educational technology; discusses the need for such a bill.

2636. Boyer, E. L., "A Lifetime of Learning: The Educational Challenge of the Seventies", *Vital Speeches of the Day*, v. 38, no. 19, 15 July 1972, pp. 592-594.

Outlines major factors which are likely to bring about an increase in the length of formal learning and a variation in the segment of the population to be served: the increasing number of people comprising the older segment of the population, the trend toward a shorter work week with a resulting increase in leisure time, and the recognition by workers of the need to keep pace with developments in their field; suggests strategies for making education a continuing, lifetime experience: inter-

spersal of education years with work years, formation of a partnership between education and industry in planning ways to intersperse formal and informal study throughout the working years, and development of more education programs for retired people.

ENERGY – CRISIS

2637. "Rickover Urges Energy Conservation", *Washington Science Trends*, v. 28, no. 13, 3 July 1972, p. 74.

Presents Vice Admiral Rickover's views on the U.S. energy crisis: (1) the energy crisis results from the fact that consumption proceeds at geometric progressions and supply is finite; (2) assertions that resources are ample and that only more exploration and development are needed blur the real problem – fixed assets, limitless consumption demands; outlines Rickover's proposals for energy conservation: an immediate halt to energy exports, discouragement of the inefficient use of energy, a ban on air conditioning (except for required industrial or medical purposes), taxation of automobiles such as to discourage the use of heavy, high-powered cars, and a revamped price structure for utilities.

2638. Makhijani, A. B., and Lichtenberg, A. J., "Energy and Well-Being", *Environment*, v. 14, no. 5, June 1972, pp. 10-18.

Evaluates the degree of efficiency in the use of energy and materials in the U.S., concluding "that the present efficiency in both energy and material-resources utilization is low and that considerable improvement is possible"; examines the relationships between pollution, national GNPs, standards of living, and energy consumption per capita; presents a number of graphs and tables illustrating the trends in energy consumption.

2639. Szego, G. C., *The U.S. Energy Problem: Volume 1, Summary*, InterTechnology Corporation Report prepared for the National Science Foundation, November, 1971, 67 pp. (Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22151. Price: $4.85.)

Summarizes the findings of a study to provide guidance to NSF in the choice of priorities in energy-related R&D offered for government support; the study dealt with energy and power problems, and with various aspects of the U.S. energy economy; the findings pointed up the failure of the Government, as yet, to set specific, quantitative conservation goals, state national energy priorities, and marshall resources to deal with the problem; the intolerably low level of R&D support; lack of study of non-R&D alternatives (tax incentives, energy supply priorities, etc.) and their consequences; and the need for more accurate forecasting of power demand, for a siting decision methodology, and for application of reliability analysis to utilities.

2640. Faltermayer, E., "The Energy 'Joyride' is Over", *Fortune*, v. 86, no. 3, September 1972, pp. 99-101, 178, 180, 182, 184, 186, 188, 191.

Outlines factors contributing to the energy crisis, and contends that "technology and good sense can stretch our resources – but only a big breakthrough can bring back cheap fuel and power"; discusses the prospects of using the vast amounts of coal for clean energy, and the potential of nuclear energy (both fission and fusion), solar energy, and sea thermal gradients as practical sources of power.

2641. Moss, F. E., "Environmental Challenge", *Congressional Record*, v. 118, no. 136, 5 September 1972, pp. S14063-14064.

Presents the text of the section on minerals of the National Wildlife Federation's evaluation of global environmental quality, produced in cooperation with the U.N. Conference on the Human Environment; discusses resource shortages and some possible energy sources for the future, such as nuclear, solar, hydroelectric, and geothermal.

2642. "More About That Exponential Curve", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 53-54.

Reports views expressed at the M.I.T. alumni seminar, a symposium at the American Geophysical Union meeting in Washington, and one at the American Chemical Society meeting in Boston; discussions covered such topics as the

exponential curve of energy use, obtaining fuels from pitch, the extent of fossil fuel reserves, the increasing cost of fossil fuels and the energy they produce, the shortage of natural gas, and the environmental impact of mining oil shale; one participant pointed out that the U.S. presently devotes 1/10 of its GNP to the purchase of energy and to the consequences of cheap energy.

2643. *Raw Materials in the U.S.: 1900-1969*, U.S. Bureau of the Census, Working Paper No. 35. (Available from U.S. Bureau of the Census, Washington, D.C. 20233. Price: $1.00.)

Presents the findings of a U.S. Bureau of Census study on raw material consumption; highlights include: increases in domestic raw material output aided by an abundance of technology have, nevertheless, failed to keep pace with growth in either population or demand; while population has increased by 166%, total use of raw materials increased by 295% – a 49% increase in per capita consumption; the major change was the 195% increase in per capita consumption of energy materials (such as coal, oil, and gas) since 1900, which, in turn, has brought about an increasing reliance on foreign supplies – "statistics which take on new meaning as the nation attempts to cope with threats of energy shortages and a deteriorating import/export balance of trade".

2644. Gage, S. J., "The Power Crisis & Building Systems Design", *Heating, Refrigerating & Air Conditioning Journal*, July 1972, pp. 25-28.

Discusses the nature of the energy crisis in the U.S., future energy requirements, and increasing energy costs; projects future energy utilization of buildings, mechanical systems, and discusses the role of the design engineer in energy conservation, illustrating the savings in energy resources that might be realized through improved design, operation, and maintenance of comfort conditioning systems.

ENERGY – ENVIRONMENT

2645. Ikard, F. N., "Energy & Economics: The Problems are Basic and Complex", *Vital Speeches of the Day*, v. 38, no. 23, 15 September 1972, pp. 728-32.

Discusses the energy/environment dilemma, the basic economic problem of the U.S. – the demand for energy – and the importance of energy supplies to the economic development of the developing countries; contends that "there is nothing incompatible between energy requirements and a clean environment, unless by our lack of common sense we make it so"; outlines the actions necessary to meet the U.S.'s immediate (within 10 to 15 years) energy requirements: (1) expedite the movement of Alaska oil and gas to market; (2) speed up leasing of additional acreage on the Outer Continental Shelf; (3) take steps to attract funds to increase the supply of oil and natural gas; and (4) develop new supplies of low-sulfur coal.

2646. Daub, W. O., "Environmental Foresight: AEC's Approach to Environmental Management", *AEC News Releases*, v. 3, no. 30, 26 July 1972, pp. 7-10.

Describes a new approach to environmental management which stresses prevention of pollution and preservation of environmental quality, as opposed to remedial actions to decrease pollution and environmental damage; emphasizes the need for an energy/environment balance, and describes cost/benefit analysis as a device for achieving such a balance; suggests close attention to AEC guidelines for submission of benefit/cost information, and recommends that utilities "benefit from hindsight, but rely on ... environmental foresight, in preparing their environmental reports".

2647. Quarles, J. R., Jr., *The Electrical Power Industry and the Environment*, Address to Edison Electric Institute's Eighth Biennial Financial Conference, Miami, Fla., 16 May 1972, 12 pp. (Available from U.S. Environmental Protection Agency, Washington, D.C. 20460.)

Outlines the problems facing the electric power industry in providing adequate power, yet meeting environmental standards; describes the economic consequences of environmental protection, and stresses the need for continued large growth of the industry; discusses three specific problems: setting pollutant standards, dealing with thermal pollution, and power plant siting.

2648. Washburn, C. A., "Clean Water and Power", *Environment*, v. 14, no. 7, September

1972, pp. 40-44.

Emphasizes that "examination of possible secondary pollution is absolutely essential whenever steps are proposed to alleviate environmental degradation"; addresses the question of "whether the secondary pollution caused by the electrical power requirements of environmental clean-up efforts will approach or outweigh the benefits gained"; concludes that secondary pollution caused by providing electrical energy for cleaning our water is minimal, and that continued growth of electric power demand cannot be attributed to waste-water-treatment needs.

2649. *Summary of Committee on Power Plant Siting (COPPS) Forum II Proceedings, March 7-8, 1972, Washington, D.C.*, National Academy of Engineering, April 1972, 84 pp. (Available from Committee on Power Plant Siting, National Academy of Engineering, 210 Constitution Ave., N.W., Washington, D.C. 20418.)

Summarizes the findings of the 2-day Forum called to evaluate the conclusions and recommendations of the COPPS report on resolution of energy/environment conflicts [*SPR* 5(1): 1822]; the agenda included panel discussions of needed federal and state legislation and R&D, as well as 5 workshop sessions; general endorsement was given to COPPS recommendations relative to: use of system approaches to meeting power requirements, consolidated certification procedures, effective provision for public information, responsible consideration of all interests, and enlarged coordinated R&D effort.

2650. Holifield, C., "Public Power's Role in the National Energy Picture", *Congressional Record*, v. 118, no. 107, Part II, 29 June 1972, pp. H6430-6433.

Emphasizes the need for an adequately funded, coordinated, national energy and pollution-control R&D effort; urges Congress to consider legislation which would consolidate the existing environmental laws into an understandable and workable legislative framework; points out that changes are needed in the organizational structure of both the executive and legislative branches to facilitate the achievement of the two goals of supplying adequate energy and protecting the environment; calls for greater cooperation by the utility industry in planning and funding research efforts and in regional planning.

2651. *Problems of Electrical Power Production in the Southwest*, Report of the Committee on Interior and Insular Affairs, U.S. Senate, Report No. 92-1015, 1972, 296 pp. (Available from the Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C. 20510.)

Analyzes the broad energy problems and public policy issues involved in the operation and construction of coal-fired powerplants in the "Four Corners" region (which comprises parts of Colorado, New Mexico, Arizona, Utah, and Nevada); presents a list of findings and recommendations, including: the "Four Corners" situation is a culmative effect of past short-term resource-management decisions, and legislation designed to improve powerplant siting decisions should be enacted to establish procedures for open long-range planning, timely siting decisions, and smooth, predictible construction schedules.

ENERGY – FUEL SUPPLY

2652. Ritchings, F. A., "Trends in Energy Needs", *Mechanical Engineering*, v. 94, no. 8, August 1972, pp. 18-24.

Presents a brief rundown of U.S. energy requirements as related to total world requirements, the sources of energy consumed in the U.S., the major users of the energy consumed, and predictions as to the rate of increase in U.S. energy consumption; highlights include: the U.S., with 6% of world population, consumes 34% of world energy; over a 10-year period (1958-68), the use of all U.S. raw-energy sources increased in absolute quantities, and this trend is expected to continue, with predicted increases (from 1970-1990) in annual consumption of 40% for coal, 90% for oil, and 75% for gas, and with nuclear sources providing 20% of total U.S. energy consumed (19% more than in 1970); in 1970, the industrial sector was the major consumer of U.S. raw energy (30%), while the electric generation sector is projected to be the major consumer in 1990 (40%).

2653. "Does Underground Coal Gasification Have a Future", *Inside R&D*, v. 1, no. 10, 7 June 1972, p. 3.

Describes the underground coal gasification process, which is receiving renewed interest in view of today's high mining costs, concern for the health and safety of miners, and pollution factors; points out the chief problems with this process (low heat value of the gas and the need for special turbines) as well as its potential (less air pollution and avoidance of mining); suggests that millions of tons of low-grade coal reserves in the U.S. might be exploited by such a technique.

2654. "Electric Research Council Seeking 'Cleaner' Coal", *Inside R&D*, v. 1, no. 23, 6 September 1972, p. 4.

Announces the Electric Research Council's establishment of a task force to evaluate various methods for reducing sulfur content of coal already proposed and to design an R&D program for finding new techniques; this move makes two points clear: (1) U.S. utility companies must rely heavily on coal for future power production, and (2) existing processes for cleaning up coal before burning have not met the needs of utilities.

ENERGY – NATIONAL POLICY

2655. Hardesty, C. H., Jr., "The Critical Path to Adequate Supplies of Energy: A National Imperative", *Vital Speeches of the Day*, v. 38, no. 18, 1 July 1972, pp. 548-552.

Examines the overall energy-supply situation; cites projected figures on energy requirements and supplies from 4 major sources of energy (coal, gas, oil, and nuclear power) which indicate that the U.S. will experience critical energy-supply problems by 1985; calls for prompt action on the part of government, industry, the public, and the press, and for "the creation of a national energy policy which not only comes to grips with, but provides the means of resolving the critical issues".

2656. "Wanted: A National Energy Policy", *Environmental Science & Technology*, v. 6, no. 7, July 1972, p. 601.

Presents opinions concerning the need for a national energy policy expressed in hearings before the House Subcommittee on Science, Research, and Development; E. David, director of the Office of Science and Technology, favors the liquid metal fast breeder reactor, while Rep. M. McCormack considers coal gasification equally important; notes the indecision as to the best governmental structure for dealing with the energy crisis – whether to establish a new energy commission in the proposed Department of Natural Resources, broaden the activities of the AEC to include other forms of energy, or establish an energy agency within the existing administrative structure.

2657. Hammond, A. L., "Energy Options: Challenge for the Future", *Science*, v. 177, no. 4052, 8 September 1972, pp. 875-876.

Describes concerns over increasing demands for energy, and stresses the need for a far-sighted national energy policy, for greatly increased energy R&D, and for a major reordering of funding patterns for energy R&D; outlines the nuclear (breeder reactors) and nonnuclear energy technologies that should – with increased federal spending and leadership – be commercially available by 1985: solar, geothermal, coal gasification, shale oil, fluidized bed coal, combustion gas and steam turbine generation of electricity, dry cooling towers (obviating the need for water for cooling purposes), and fuel cells for total energy installations; briefly describes the changing pattern of energy use and expected future trends.

ENERGY – NUCLEAR

2658. *Major Activities in the Atomic Energy Programs, January-December, 1971*, U.S. Atomic Energy Commission, January 1972, 249 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.50.)

Reports on the AEC's regulatory activities, activities in the environmental safety area, and activities associated with the operating and developmental functions during 1971; highlights include: (1) reshaping of the regulatory process to achieve proper regard for environmental quality, increased efficiency in licensing and regulation, and more effective public participation in the process; implementation of a Court directive which made the AEC directly responsible for assessing the

total environmental impact, including thermal effects of nuclear powerplants; increased efforts in the environmental safety area (impact statements, radioactive waste management, assessment of thermal and radiation effects); conduct of a test of the Spartan warhead (Cannikin test); formulation of plans for breeder reactor demonstration plants; and conduct of nuclear gas stimulation experiments (Project Plowshare).

2659. Muntzing, L. M., "The Changing AEC Regulatory Process", *AEC News Releases*, v. 3, no. 37, 13 September 1972, p. 3.

Presents projections offered by the Federal Power Commission which call for: (1) the demand for electrical energy to double from 1970 to 1980 and to redouble by 1990; and (2) nuclear power to supply 28% of this energy by 1980 and 49.3% by 1990; describes efforts of the Atomic Energy Commission to improve its regulatory performance so as to deal adequately with projected demands for nuclear power: for example, reduction of licensing review time, development of regulatory standards, revision of the Standard Format for the Preparation of Safety Analysis Reports for power reactors, issuance of a guide for submission of cost/benefit analysis of nuclear facilities, and promotion of standardization in nuclear plant design.

2660. Evins, J. L., "Nation's First Liquid Metal Fast Breeder Demonstration Reactor to be Built in Tennessee", *Congressional Record*, v. 118, no. 130, 14 August 1972, pp. E7476-7477.

Commends the decision to locate the liquid-metal fast-breeder nuclear reactor demonstration project in Tennessee near the Atomic Energy Commission's Oak Ridge facility; describes funding for the project which is a joint venture between the Tennessee Valley Authority, the AEC, and private utilities; reprints a TVA announcement describing the plant site, construction plans, costs, and power capabilities, along with an article examining the reasons for locating the plant at Oak Ridge.

2661. "Offshore Nuclear Power", *Newsweek*, v. 80, no. 14, 2 October 1972, p. 69 (see also *New Scientist*, v. 55, no. 812, 21 September 1972, pp. 474-476).

Describes what may be at least a partial answer to the energy/environment dilemma – the U.S.'s first offshore nuclear power plant; the $1.1 billion station, scheduled to begin supplying power by 1980, is to be moored 12 miles northeast of Atlantic City, N.J.; the plant will consist of 2 floating reactors connected to the mainland by power cables buried under the seabed, and will be surrounded by a massive seawall to protect it from waves, storms, hurricanes, and potential shipwrecks; so far, most environmentalists appear to find offshore plants environmentally acceptable, and are limiting their protest against the New Jersey plant to requests for more detailed research on the possible effects of such plants on the seawater around them.

2662. *Questions and Answers About Nuclear Power Plants*, Environmental Protection Agency Pamphlet, 1972. (Available in quantity from U.S. Government Printing Office, Washington, D.C. 20460. Price: 15 cents each and $11.25 per thousand. Free single copies available from Public Inquiries Branch, EPA Office of Public Affairs, Washington, D.C. 20460.)

Contains answers to questions concerning a variety of nuclear-power-related issues, including the possibility of a reactor accident, the health effects of radiation, the disposal of radioactive solid waste, the causes of thermal pollution, and the amount of radiation released into the environment by nuclear reactors.

2663. Gillette, R., "Nuclear Safety (I): The Roots of Dissent", *Science*, v. 177, no. 4051, 1 September 1972, pp. 771-774, 776.

Traces the public concern over the adequacy of backup cooling systems in nuclear plants to problems in the management of nuclear safety programs, and to an intense discord that has developed between the Atomic Energy Commission and its national laboratories; points out that increasingly powerful nuclear plants are being built, while testing facilities have not been completed, research is unfinished, and there are many unsettled safety questions; notes Government officials' view – that nuclear plants are designed with enough conservatism to make up any uncertainties in their performance, a view which safety researchers do not share.

2664. Gillette, R., "Nuclear Safety (II): The Years of Delay", *Science*, v. 177, no. 4052, 8 September 1972, pp. 867-871.

Pinpoints the causes of the delays and cost overruns in important safety research projects – the LOFT (Loss of Fluid Test) reactor and the PBF (Power Burst Facility): major design changes and changes in the main test to be performed ordered by the AEC when construction was about to begin, and application of strict new quality standards to the construction of the two reactors; explores the controversy between the AEC and Phillips Petroleum (the operating contractor at the National Reactor Testing Station) and the question as to who, if anyone, is to blame for the lag in the projects; points out that acceleration of the breeder program diverted funds allocated for "research intended to resolve questions of the utmost urgency pertaining to dozens of commercial nuclear power plants then on the drawing boards or under construction".

2665. Gillette, R., "Nuclear Safety (III): Critics Charge Conflicts of Interest", *Science*, v. 177, no. 4053, 15 September 1972, pp. 970-972, 974-975.

Examines the factors which prompted the charges of conflicts of interest leveled against the AEC's Division of Reactor Development and Technology, of which the safety program is a part; describes opposing functions of the AEC – promotion and regulation of the nuclear industry – which form the basis for these allegations; discusses the concerns of safety researchers over cutbacks in the nuclear safety program, and their growing conviction that Washington authorities are shaping the nuclear safety program to the desires of the nuclear industry and are sidestepping questions of water-reactor safety so as not to jeopardize industry's financial support of the breeder program; reports the initiation by the General Accounting Office of an investigation into the turbulent relations between the safety program and the regulatory arm of the AEC.

2666. Gillette, R., "Nuclear Safety (IV): Barriers to Communication", *Science*, v. 177, no. 4054, 22 September 1972, pp. 1080-1082.

Discusses various actions of the U.S. AEC to suppress discussion of reactor safety issues, not only before the public but also within the nuclear profession: limitation of communication between safety researchers and the regulatory/licensing branch of the AEC; refusal to allow delegations of foreign nuclear researchers and regulatory officials to talk over mutual safety concerns with researchers at the Idaho test station; attempts to block a symposium on reactor safety scheduled by the American Nuclear Society; and rejection of a remedy favored by a majority of safety program managers – transferring control of the water-reactor portion of the safety program from the AEC's development branch to the regulatory/licensing authorities; describes expressed doubts as to the ability of Government officials to conduct safety research in a manner fully benefitting the public welfare.

2667. Ford, D. F., and Kendall, H. W., "Nuclear Safety", *Environment*, v. 14, no. 7, September 1972, pp. 2-9, 48.

Reviews carefully the entire controversy surrounding the adequacy of the Atomic Energy Commission's design standards for emergency core cooling systems in nuclear power plants; discusses the principles and problems of ECC, and examines the questions raised by the AEC's own experts concerning the safety criteria; points out that the AEC is, nevertheless, proceeding with the licensing of 17 nuclear power plants, and is continuing to rely upon the low probability of an accident occurring, and to stress the dependability of its quality assurance program and the conservatism of its safety criteria.

2668. Patterson, W., "U.S. Ponders Possible Runaway Reactors", *New Scientist*, v. 55, no. 812, 21 September 1972, pp. 476-478.

Describes concerns over the safety of nuclear reactors, and questions as to the reliability of emergency core cooling systems (ECCS); discusses a commentary on ECCS published by the Union of Concerned Scientists ("Nuclear Reactor Safety: An Evaluation of New Evidence") which reveals the shoddy safety research and the ill-conceived, inadequate experiments conducted by reactor manufacturers at the instigation of the AEC; describes the reactions of citizens groups to that commentary, which prompted the AEC to hold public hearings, and the disconcerting evidence brought to light by the hearings – episodes of concealment and suppression of information, the extent of dissatisfaction over the ECCS within the

AEC, and the AEC's disregard of warnings by certain members of its staff.

2669. Sagan, L. A., "Human Costs of Nuclear Power", *Science*, v. 177, no. 4048, 11 August 1972, pp. 487-493.

Analyzes the costs of producing and using nuclear fuel to generate electricity, on the basis of the value of human life, lost productivity, and potential effects of radiation, presents statistics on deaths and number of lost work days (due to injury) resulting from accidents in fuel and reactor manufacturing activities, as well as data on the yearly costs to society of the U.S. nuclear industry and the risks to individuals involved (both assessed in dollars); cites a study which reveals that current exposure of the public to radiation from nuclear plants is far lower than that from diagnostic X-rays (430 man-rems versus 18.7 man-rems); contends that the overrestriction of the public's exposures cannot be justified on an economic basis.

2670. Weinberg, A. M., "Social Institutions and Nuclear Energy", *Science*, v. 177, no. 4043, 7 July 1972, pp. 27-34.

Reviews broadly the status of the nuclear energy enterprise and its most troublesome problems; speculates on the new and peculiar demands mankind's commitment to nuclear energy may impose on human institutions; discusses nuclear power and the environment, nuclear plant technology and safety, and the problem of nuclear waste disposal.

2671. Sherfield, L. (Ed.), *Economic and Social Consequences of Nuclear Energy*, Science and Engineering Policy Series, Oxford University Press, London, England, 91 pp. ($3.50)

Describes, in the introduction, the history of atomic power, from the atom bomb to the present status as an energy source; contains 6 chapters dealing with the science of fission and fusion processes (R. Spence), the technological development of the uranium and "hydrogen" bombs (D. Barnett), and the U.K.'s nuclear power program (S. Brown), as well as with the potentialities (H. Kronberger), the moral aspects (R. C. Mortimer), and sociological consequences (Ritchie-Calder, L.) of nuclear energy.

2672. Robinson, D. Z., et al., *Nuclear Energy Today and Tomorrow*, Heinemann, London, and Edinburgh, September 1971, 473 pp. ($3.25)

Presents a number of lectures given in Sydney, Australia, to the Twelfth International Science School for High School Students; covers a wide field of nuclear science and technology ranging from cosmic rays, the elementary particles, and nuclear forces to the science/society relationship, the peaceful uses of the atom (e.g., nuclear power), and the use of radioactive isotopes.

2673. "Energy Research: Nuclear Stays on Top", *Science & Government Report*, v. 11, no. 10, 15 July 1972, p. 2.

Discusses a speech by Rep. C. Holifield to the American Public Power Association, in which he represented the views of an atomic power block in Congress; Rep. Holifield emphasizes that any reorganization of government energy research programs must assure the continued dominance of atomic energy, discusses the proposed Department of Natural Resources, and points out that the President already has the authority to "consolidate energy R&D activities into a single agency".

2674. Gofman, J. W., "Is Nuclear Fission Acceptable?", *Futures*, v. 4, no. 3, September 1972, pp. 211-219.

Considers the validity of A. M. Weinberg's projections of the ultimate global population and energy consumed per capita, and of arguments favoring nuclear fission as a future energy source; describes the enormous safety and supply problems connected with providing energy at the levels projected; points out that solar energy is highly abundant and, in the long run, will probably be more economical than nuclear power.

2675. "Trace Elements Detailed in Lake Michigan", *Chemical & Engineering News*, v. 50, no. 30, 24 July 1972, p. 59.

Describes the findings of an extensive chemical baseline study on Lake Michigan by Environmental Research Group, Inc., which covers the distribution of 35 trace elements in the Lake, water, sediment, and 3 levels of invertebrates; the study

reveals that there will be no hazards from radioactivity if nuclear power plants around the Lake operate within Atomic Energy Commission guidelines.

ENERGY RESEARCH

2676. *Energy Research Needs*, A Report to the National Science Foundation prepared by Resources for the Future, Inc., in cooperation with MIT Environmental Laboratory; October 1971, 860 pp. (Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22151. Price: $13.50.)

Attempts to define major energy-research needs involving economics and energy policy; deals with all aspects of energy, including the forces affecting U.S. energy consumption, future mineral reserves, unconventional sources of gaseous and liquid fuels, electric energy from fossil and nuclear fuels, residential utilization technology, environmental effects, and policy issues.

2677. "Scientist-Congressman Studies Priorities for Energy R&D", *Physics Today*, v. 25, no. 7, July 1972, pp. 61-63.

Reports on a discussion with Rep. M. McCormack, head of a Task Force on Energy and the only scientist in Congress, concerning the activities of the Task Force, a timetable for energy innovation, and the need for a national energy agency; McCormack urges expanded energy R&D, and favors establishment of an official governmental energy policy.

2678. *An Inventory of Energy Research*, Prepared for the Task Force on Energy, Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, U.S. House of Representatives, by Oak Ridge National Laboratory with the support of the National Science Foundation, March 1972, Vols. I and II, 1724 pp. (Available from Committee on Science and Astronautics, U.S. House of Representatives, Suite 2321, Rayburn House Office Building, Washington, D.C. 20515.)

Lists (in Vol. I) approximately 4400 projects relating to energy research under 14 categories of energy sources: Fossil Fuels (General), Coal, Petroleum, Natural Gas, Nuclear (General), Nuclear Fission, Nuclear Fusion and Plasmas, Hydraulic, Solar, Geothermal, Wind, Wood and Other Biological, Chemical, and Unspecified; Vol. II contains simple indexes on research institutes, sponsors, and principal investigators, and a permuted index on titles.

2679. "Government Incentives for Industrial Research", *Inside R&D*, v. 1, no. 13, 28 June 1972, p. 4.

Presents views of Department of Commerce Secretary Peter Peterson expressed in an address at a June meeting of the National Coal Association, which indicate that energy R&D is apt to be the first segment of industrial research to receive government incentives; according to Secretary Peterson, there is a need for more government-industry cooperation on energy R&D, and there has been insufficient incentive for industry to commit research dollars to this area; Secretary Peterson, long a supporter of an incentive program for R&D, is searching for the most effective way of stimulating R&D in various areas.

2680. "Government and Utilities to Up R&D Spending on Power Generation and Transmission", *Inside R&D*, v. 1, no. 14, 5 July 1972, p. 4.

Describes a cooperative effort by the Federal Government and the power industry designed to increase the industry's R&D activities; the Electric Power Research Institute (New York, N.Y.), which ultimately will spend $150 million for research, has been established to replace the Electric Research Council, a voluntary group of investor-owned utilities that has contracted out some $40 million in research funds; the new group may eventually conduct some of its own R&D.

ENERGY – UNCONVENTIONAL SOURCES

2681. Gaucher, L. P., "The Solar Era: Part 1 – The Practical Promise", *Mechanical Engineering*, v. 94, no. 8, August 1972, pp. 9-12.

Discusses the future need for and vast potential of solar energy; examines past energy consumption trends and forecasts future trends; points out that a great deal of work will be necessary to develop large satellite collection and transmission

systems and for development of large sophisticated solar energy complexes, giving an example of such a complex; describes two energy studies now being undertaken by government agencies and the pertinent legislation before Congress, and suggests the formation of a Solar Energy Commission.

2682. "Solar Energy as a Source of Electric Power", *Inside R&D*, v. 1, no. 16, 19 July 1972, pp. 2-3.

Reports the establishment of a project on conversion of solar energy to be conducted jointly by the University of Minnesota and Honeywell, Inc., with nearly 1/2 million dollars in government funds; underscores the potential of solar energy as expressed by a representative of the University -- materials and processes exist to convert 20% of the solar energy falling to earth into usable electric power, and such a capacity, if achieved, could supply all U.S. power needs for many years to come; describes the effects of the commercialization of solar power, and its significance for traditional power companies.

2683. Hudock, R. P., "Harnessing the Sun", *Astronautics & Aeronautics*, v. 10, no. 7, July 1972, pp. 6-9.

Describes the "energy crisis", emphasizing the vast energy requirements predicted for the future; suggests that solar energy has the greatest long-term potential of the several nonconventional energy sources, despite the enormous costs involved in converting solar energy to a usable form; describes various conversion methods, the possible use of satellites to generate electricity from solar energy, and the need for greater funding of solar energy R&D programs.

2684. Hammond, A. L., "Solar Energy: The Largest Resource", *Science*, v. 177, no. 4054, 22 September 1972, pp. 1088-1090.

Describes the potential, present state of development, uses, technical problems, and possible environmental impacts of solar energy; discusses the need for increased funding for solar energy research, which at present accounts for only 1% of Federal research expenditures in the energy field; points out that while space heating and cooling with solar energy is not available today, solar-thermal power plants have yet to be built on any but the smallest scale, and key elements of the necessary technology have not been demonstrated, both applications appear to be close enough to practical tests of their economic feasibility to warrant increased efforts.

2685. Hammond, A. L., "Geothermal Energy: An Emerging Major Resource", *Science*, v. 177, no. 4053, 15 September 1972, pp. 978-980.

Describes the potential of geothermal energy, the 3 types of geothermal resources being considered (steam, hot water, and hot rock), and possible methods of exploiting these resources; notes that electric power is being produced commercially from geothermal energy in 7 countries, including New Zealand, Japan, and the Soviet Union; discusses the as yet unanswered questions concerning geothermal energy, such as the best prospecting technique, methods of controlling the corrosiveness of the mineral-laden hot water, the inefficiency of turbines at low temperature, means of controlling environmental pollution, and possible seismic disturbances or land subsidence; stresses that concerted effort and strong financial support for exploration and technology development will be required to develop geothermal power by the end of this century.

2686. Bacon, F., and Fry, T., "When There's No More Oil and Gas...", *New Scientist*, v. 55, no. 808, 10 August 1972, pp. 285-287.

Discusses the dangerous shortages of fossil fuels facing the world in the near future; suggests that hydrogen, either gas or liquid, is the only likely synthetic substitute; describes methods of obtaining hydrogen from water, how it could be used, and its energy transmission capabilities.

2687. Thomsen, D. E., "MHD: High Promise, Unsolved Problems", *Science News*, v. 102, no. 9, 26 August 1972, pp. 138-140.

Describes the present status of magnetohydrodynamic (MHD) technology and MHD plant operation (which exists primarily in Russia at present); discusses the technical problems involved in making MHD a practical energy source, which stem from the high operating temperature, the nature of the fuel, and a combination of both; describes efforts in the U.S. to achieve Administration support for MHD

R&D.

2688. "Laser Fusion Grows Respectable", *Technology Review*, v. 74, no. 8, July/August 1972, p. 51.

Describes work being done on laser-induced fusion, and its significance in the development of fusion power reactors; work of this type by a private company was earlier halted by the Atomic Energy Commission out of concern for the fact that it might lead to fabrication of a nuclear explosive device; in view of the energy crisis and the prospects for controlled nuclear fusion – with its promise of unlimited power from the hydrogen of the sea – the AEC has recently permitted the company to continue its work, so long as it is directed solely toward peaceful applications.

2689. Metz, W. D., "Laser Fusion: A New Approach to Thermonuclear Power", *Science*, v. 177, no. 4055, 29 September 1972, pp. 1180-1182.

Reviews the state of the art of laser fusion development and laser reactor design; examines the potential of laser fusion as a means of producing energy and discusses the many technical problems yet to be solved; points out that the laser approach, in bypassing the need for a magnetic field, has also bypassed a long catalogue of plasma instabilities, but suggests that more major breakthroughs in laser development may be necessary for laser fusion to become feasible.

ENVIRONMENT – BIBLIOGRAPHY

2690. *An Environmental Bibliography*, prepared by the Editorial Research Section, Office of Public Affairs of the Environmental Protection Agency, 1971, 16 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 15 cents each; $11.25 per 100.)

Contains 45 references to writings addressed to policy issues and interdisciplinary concepts, rather than to specific problems and their technical solutions; points out that the limitations of this listing are ameliorated by the fact that many of the books listed include excellent bibliographies of their own.

2691. *A Bibliography of Doctoral Research on Ecology and the Environment*, XEROX, 1972, 92 pp. (Available from University Microfilms, A Xerox Education Company, 300 North Zeeb Road, Ann Arbor, Michigan 48106.)

Serves as a guide to dissertations accepted at American universities during the period 1938-70; lists over 900 dissertations covering every aspect of study relating to ecology and the environment around the world, giving name of author, full title of dissertation, name of accepting institution, and the date of completion; includes ordering information.

ENVIRONMENT – GLOSSARY

2692. *Miljoordlista – Glossary of Environmental Terms*, Swedish Centre of Technical Terminology, 1972, 92 pp. (Available from Swedish Centre of Technical Terminology, Box 43041, S-10072 Stockholm 43, Sweden. Price: 20 Skr. [ISBN 91-7196-050-3].)

This publication, which appeared at the U.N. Conference on the Human Environment, presents definitions of environmental terms in 4 languages Swedish, English, French, and German.

ENVIRONMENT – INTERNATIONAL COOPERATION

2693. Austin, J. P., "Toward Environmental Equilibrium ... Ex Terra Pax", *Vital Speeches of the Day*, v. 38, no. 21, 15 August 1972, pp. 652-655.

Stresses the need for global cooperation – among the governments, enterprises, and peoples of all nations – to ameliorate the environmental crises confronting society today; points to errors of industrialized nations which led to environmental degradation, and urges developing countries to take advantage of existing technology to avoid these errors; asserts that "the solution to environmental problems must enhance productivity rather than limit it" and that "creative solutions can produce profit"; advocates recycling, increased research efforts by industry, and

the establishment of international standards and controls.

2694. *The Need for a World Environmental Institute*, Committee of Commerce, U.S. Senate, March 1972, 22 pp. (Available from Committee on Commerce, U.S. Senate, Washington, D.C. 20510.)

Presents the findings and recommendations of the Joint Colloquium on International Environmental Science held to consider, primarily, the need to deal with environmental problems at an international level, and the role of scientific information – and information exchange – in doing so; recognizing (1) that man's mismanagement of technology and resources poses a threat to global environmental quality, and thus to the long-term future of human society, and (2) that effective international management and decision-making processes are essential to the solution of global environmental problems, the Colloquium accordingly recommended the establishment of a World Environmental Institute to provide the necessary technical and scientific information to those processes; appended is the U.S. Senate Resolution calling for the creation of a World Environmental Institute.

2695. "U.S. and Soviets: 30 Joint Projects on Environment", *Science News*, v. 102, no. 14, 30 September, 1972, p. 212.

Describes a recent U.S.-Soviet agreement on a 30-project cooperative program involving joint U.S.-Soviet teams working in both countries; for example, Soviet scientists will study air pollution in St. Louis and water pollution in Lake Tahoe, while U.S. scientists will examine similar problems in Leningrad and Lake Baikal; points out the benefits to be realized by each nation from pooling of knowledge.

ENVIRONMENT – MAN INTERACTION

2696. Wullstein, L. H., McNulty, I. B., and Klikoff, L. (Eds.), *Environment, Man, Survival*, Grand Canyon Symposium 1970, Department of Biology, University of Utah, Salt Lake City, Utah, 1971, 111 pp. ($3.00)

Presents a collection of papers concerned, for the most part, with several aspects of the man-environment interaction: "Pollution and Political Systems" (G. Hardin); "The Population Crisis and the Adequacy of Policies Designed to Meet It" (K. Davis); "Man's Part in His Own Biological Future" (R. D. Hotchkiss); "Limitations on Food Production" (C. C. Delwiche); "Implications of Success and Failure in the Control of Pesticides" (N. W. Moore); "Use Without Abuse of Our Water Resources" (R. Patrick); "Can We Afford Wilderness?" (R. Nash).

2697. Downs, A., "Up and Down with Ecology – the Issue-Attention Cycle", *The Public Interest*, no. 28, Summer 1972, pp. 38-50.

Analyzes the "issue-attention" cycle to explain the shift in public attention toward the environmental issue and its sudden assumption of high priority; suggests that while the issue is now in the 3rd stage of the cycle (realization of the cost of solving the problem), certain factors are likely to keep the issue alive for some time (e.g., the high visibility of pollution, and the threat to the entire population); cites, for example, the American public's characteristic resistance to major change as a basis for predicting that the issue will lose attention, but at a much slower rate than have other domestic issues.

2698. Goldsmith, M. (Ed.), *The Predicament of Man: An Examination of Policies for the Future*, Based on Science Policy Foundation's Third International Symposium, London, England, 5-7 April 1971, Inforlink Ltd., (PM), 2A Station Rd., Frimley, Surrey, England, 1972, 162 pp. (£4.40).

Presents a compilation of papers (1) describing the elements contributing to the predicament of man [*SPR* 4(4): 1239]; (2) dealing with the technological and social aspects of man's future; (3) offering a capitalist's and a socialist's view of the role of geopolitical man in decision making, his responsibilities, and his contribution to future progress; and (4) describing means of planning for international cooperation and the role of international organizations; includes discussions and commentaries on the papers and statements presented during a discussion on "Design for Society" – a design for change; contributors include such well-known science policy personalities as R. Dubos, M. Goldsmith, and E. B. Skolnikoff.

2699. Williams, C. W., Jr., "Inventing a Future Civilization", *The Futurist*, v. 6, no. 4, August 1972, pp. 137-141.

Describes the dismal future now facing humanity and the earth if present population and pollution trends continue; suggests that 2 major steps be taken in public policy making to remedy the situation: (1) extend the time frame for policy formulation, and (2) broaden the perspective employed in policy development to take cognizance of interdependencies and qualitative consequences; contends that present decisions shape the future, that current systems of planning are failing due to their lack of vision, and that alternative futures must be created.

2700. "Homilies for the Club of Rome", *Nature*, v. 238, no. 5362, 4 August 1972, pp. 237-238.

Discusses the major shortcomings of the computer simulation of mathematical models of the earth's environmental condition by Dr. D. L. Meadows, whose work was recounted in *The Limits to Growth*, published by the Club of Rome; describes doubts about the conclusions reached through the simulation, which stem from questions as to the usefulness of computer simulation in understanding the real world, and questions concerning the validity of the assumptions made by the MIT team in setting up relationships between their mathematical variables and in the choice of initial conditions.

2701. *Annual Report, 1971*, Resources for the Future, Inc., 1972, 116 pp. (Available from Resources for the Future, Inc., 1755 Massachusetts Ave., N.W., Washington, D.C. 20036.)

Contains an essay by J. L. Fisher, President of Resources for the Future, "A New Synthesis of Economic Development and Environmental Protection", along with two special articles – "Man and His Environment: The Issues in Perspective", and "The Scrambled Pattern of Suburban Land Conversion"; highlights of the three articles include: (1) discussions of the need to strike a development/environment balance; (2) categorization of the types of environmental disruption facing mankind according to their characteristics (e.g., the localized and worldwide, the short- and long-lived, the reversible and irreversible, those that are serious and those that are merely nuisances); (3) suggestions on how to deal with environmental problems and the role of the public and technology; and (4) examination of the processes of conversion of rural land to suburban uses, their nature and effects, and means of improving them.

2702. Burson, H., "Environment: Housing's New Amenity or Curse?", *Vital Speeches of the Day*, v. 38, no. 23, 15 September 1972, pp. 711-714.

Describes the problems facing the building industry because of the public's concern over the environment and its disenchantment with growth in general; points out that all businesses cater to the demands of various publics, and suggests that "well-planned environmentally-inspired housing could be a very saleable commodity . . . it could be the most marketable amenity in housing for the balance of the 70's".

2703. "President Reports on Plans for 1974 International Environment Exposition", *U.S. Department of State Bulletin*, v. 67, no. 1733, 11 September 1972, pp. 292-293.

Announces plans for a 6-month International Exposition on the Environment to be held in Spokane, Washington, in 1974 with the theme, "How Man Can Live, Work, and Play in Harmony with His Environment"; according to the President, "in addition to stimulating trade and cultural exchanges, the exposition . . . will also focus fresh attention on one of the most pressing concerns of our time"; so far, Canada, the U.S.S.R., and Iran have accepted invitations to participate and many other countries are now expected to accept.

ENVIRONMENT – U.N. CONFERENCE

2704. Berry, R. S., "Only One World: An Awakening" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 17-20.

Describes the favorable climate for discussion prevailing at the Stockholm Conference, with general agreement among participants that the problem of maintaining

environmental quality exists and is worthy of concern as a major international issue; summarizes the achievements of the Conference, describing the actions called for by Declaration on the Human Environment and the programs to be established under the Action Plan; expresses concern over the Conference's failure to establish a requirement for international environmental impact statements; proposes the establishment of an International Institute for Technological Development to help developing nations avoid the mistakes made by developed countries.

2705. Jacobsen, S., "A Call to Environmental Order" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 21-25.

Describes the Action Plan evolving from the Stockholm Conference which consists of 106 recommendations "designed to formulate an international policy to arrest the rapid deterioration of the global environment and to set up the machinery for carrying it out"; discusses the Earthwatch program for monitoring atmospheric and marine pollution; the Action Plan also includes several recommendations on development that reflect concern for the problems of developing countries, and potential conflict over population control was deflected by announcement of a World Population Conference in 1974.

2706. Gendlin, F., "Voices From the Gallery" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 26-29.

Describes the main divisions of the unofficial sector of the Stockholm Conference: The Nongovernmental Organizations, the Environment Forum, the Distinguished Lecture Series, and a tent commune group which represented the youth input; alternative declarations on the human environment issued by various groups stressed the imbalance between the developed and developing countries in command of the earth's resources, and rejected the population explosion as the principal cause of the environmental crises; debates in the Forum centered on the population control versus technology issue; notable statements from the Lecture Series include: "The management of the earth... must take the future into consideration" (Renee Dubos); "At last, in this age of scientific discovery, our facts and morals have come together to tell us how we must live" (Barbara Ward).

2707. "Declaration on the Human Environment: A Statement of Principles" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 33-34.

Presents the text of the 26 principles which constitute the Declaration adopted at the Stockholm Conference; these principles acknowledge the fundamental right of man to freedom, equality, and adequate conditions of life; recognize man's responsibility to safeguard natural resources and wildlife, maintain the capacity of the earth to produce vital renewable resources, and to control all forms of pollution; take into account the needs of developing countries, the importance of rational planning, the proper role of science and technology, scientific R&D, and education in improving the environment; and recognize the global nature of environmental concerns, and thus the need for global cooperation.

2708. Gandhi, I., "The Unfinished Revolution" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 35-38.

Examines the underlying causes of the environmental crises being considered at the Stockholm Conference; points out specific problems facing India and offers personal views on the economic and technological development/population size/environmental degradation relationship; the more significant views (as they reflect national policies in India) include: "The environment cannot be improved in conditions of poverty. Nor can poverty be eradicated without the use of science and technology"; "It is an over-simplification to blame all the world's problems on increasing population"; "Pollution is not a technical problem. The fault lies not in science and technology as such but in the sense of values of the contemporary world...".

2709. McNamara, R. S., "A Critical Truth" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 39-43.

Appraises the state of development and the extent of poverty in developing countries; outlines the essential requirements in reconciling the developed nations' mandate to assist in the economic advance of developing nations with the responsibility to preserve and enhance the environment: recognize that economic growth is essential to developing countries; act on the evidence that properly planned growth need not cause unacceptable ecological penalties; assist these countries in selecting a growth pattern that will yield high economic gain with low environmental risk; provide the external support required by meeting the U.N. aid target of 0.7 percent of GNP; and realize that human degradation is the most dangerous pollution of all.

2710. Train, R. E., "The United States Position" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 43-44.

Expresses the U.S. view concerning international actions to preserve the quality of the environment and the vital role of the United Nations in providing coordination and leadership; outlines 12 action proposals strongly supported by the U.S.; these include: establishment of a permanent entity to coordinate multinational environmental activity; the creation of a $100 million U.N. Environmental Fund; vigorous regional action where necessary; efforts to strengthen monitoring and assessment of the global environment; international agreement on control of ocean dumping; the identification and evaluation of potential environmental impacts of proposed development activities; and the draft Declaration on the Human Environment.

2711. Mead, M., "A Loved Yet Endangered Planet" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 46-48.

Presents the statement of the Nongovernmental Organizations (NGOs) to the U.N. environmental conference which outlines the basic principles accepted by the NGOs, in brief: (1) the main focus of science and its applications in technology must be shifted to an appreciation of the interdependences of all forms of planetary existence and to scientifically sound management of ecosystems; (2) new economic perspectives must be accepted; and (3) a balance must be achieved between world economy and environmental carrying capacity; also outlines areas where new research and actions are needed — the siting and planning of human settlements, natural resource management, and environment/development balance — and describes the role of the NGOs in preserving the environment.

2712. Eban, A., "No Way Back to Eden" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 49-51.

Describes the consequences of the rapid changes brought about by revolutions in science and technology, in the use of energy, in industrial productivity, and in demographic growth and urbanization; expresses the conviction that it is not too late to remedy the situation, pointing out that "there is no valid scientific evidence... that there have been irreversible changes in the atmosphere, or that we are in danger of climatic dislocation"; warns against overstatement of the dangers and of extreme ecological alarmism which could lead to a revolt against scientific research and technical inventiveness and could inhibit the international movement for accelerated progress of developing countries.

2713. Oishi, B., "GNP — For Whom? For What?" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 51-52.

Traces the evolution of science and technology in Japan, and describes the consequences of Japan's policy of intensive expansion of the economy, with emphasis on industrial development: viz., serious destruction of the environment and the health hazards resulting from pollution; outlines environmental legislation enacted by Japan, and describes the growing application of environmental impact assessment to proposed public works projects.

2714. Benitez, H. Z., "Only One Earth: For Whom?" (Part of a Special Report on What Happened at Stockholm), *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 55-56.

Describes the especial ecological position and environmental problems of island countries such as the Philippines, underscoring the problems of major concern -- ocean dumping of wastes and depletion of marine resources in coastal waters by other countries, and the human settlements' problem ("the pollution of poverty"); proposes the inclusion of a human-settlements or housing-fund component in the Environment Fund proposed at the Stockholm Conference, and the establishment of a World Housing Program, with regional centers, to provide technical assistance to developing countries.

2715. "UN Conference Identifies Research Priorities", *R&D Management Digest*, v. 2, no. 1, July 1972, pp. 3-4.

Outlines priorities for research by national governments and UN agencies in such problem areas as methods for environmental development of urban and rural settlements, methods of assessing housing needs, socio-economic and demographic factors underlying migration and spacial distribution of the population, and alternative methods of meeting urban transportation needs; recommends international cooperation on research in such problem areas where they have a regional impact, and accelerated exchange of information concerning past and on-going research, experimentation, and project implementation covering all aspects of human settlements.

2716. "ICSU Pledges Active Role", *R&D Management Digest*, v. 2, no. 1, July 1972, pp. 4-5.

Discusses plans of the International Council of Scientific Unions (ICSU) to assume an active role in helping carry out recommendations of the UN Conference on the Human Environment; outlines steps proposed for immediate action by ICSU, in brief: (1) the organization of working groups and programs of field research in environmental investigations urgently in need of development; (2) active searching for mutually benefitting working relationships with other organizations and individual scientists; and (3) an offer of advice and service in the creation of institutional arrangements by which to ensure more effective communication between scientists and decision makers.

2717. "UN Conference Supports R&D", *R&D Management Digest*, v. 2, no. 1, July 1972, pp. 5-6.

The statement on R&D included in the Conference's declaration of principles calls for promotion of scientific R&D in the context of environmental problems in all countries (particularly the developing countries), for the support of the free flow of scientific information and experience, and for the provision of environmental technologies to developing countries; the U.S. Delegation Chairman R. E. Train considered Earthwatch and the International Referral Service the most significant recommendations; W. Ruckelshaus (U.S. EPA Administrator), felt that the Conference had been useful in further defining EPA R&D programs.

2718. Tinker, J., "Stockholm: Success or Failure?", *New Scientist*, v. 54, no. 802, 29 June 1972, pp. 754-755.

Measures the success of the U.N. environmental conference against a 14-point list of things which should have been dealt with at the Conference: for example, genetic resources, pollution controls, food standards, and the World Heritage Trust; points out that while the Conference was not a complete success, it was a notable step forward, and asserts that "nationalism, not ideology, was the Stockholm stumbling block".

2719. Schachter, O., "Proposals for Post-Stockholm", *Unitar News*, v. 4, no. 2, 1972, pp. 6-7.

Describes three major projects proposed by the United Nations Institute for Training and Research, designed to contribute to the solution of key problems in the effective implementation of international programs after the Stockholm Conference: (1) provide training in techniques of evaluating the environmental impacts of development projects, aimed at increasing the capacity of government officials and the United Nations to take environmental considerations into account in development planning; (2) conduct a study of the use of scientific expertise in environmental policy making aimed at suggesting more effective means of bringing expertise to bear while limiting it to its proper role; (3) conduct a multinational study -- through a network of national research institutions -- to provide the data

required for adequate review and assessment of the implementation of the environment programs recommended by the Conference.

ENVIRONMENTAL AGENCIES

2720. "Las Vegas Laboratory Designated National Environmental Research Center", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 2 August 1972, 2 pp.

Announces the designation of the EPA's Las Vegas, Nevada, Environmental Research Laboratory as the Agency's 4th National Environmental Research Center, describes the Las Vegas facility's past research, which consisted primarily of monitoring and sampling for radioactive pollutants in the environment, and its present capability for playing a key role in the R&D of new monitoring techniques.

ENVIRONMENTAL LEGISLATION

2721. Hartke, V., "A National Growth Policy", *Congressional Record*, v. 118, no. 125, 7 August 1972, pp. S12908-12910.

Presents 5 articles in support of the Hartke National Growth Policy Planning Act of 1972, which calls for the establishment of a national growth policy to effect economic development, population control, housing distribution, the proper uses of natural resources, and the location of governmental and private facilities in such a manner that the U.S. will continue to prosper; the act also establishes a National Growth Policy Planning Board to help coordinate growth-control efforts at all government levels.

2722. Brotzman, D. G., "Committee on Environment Urgently Needed", *Congressional Record*, v. 118, no. 122, 2 August 1972, pp. E7257-7258.

Supports a resolution to establish a standing Committee on the Environment to deal with important legislative proposals on air and water pollution, solid waste disposal, herbicides and pesticide problems, and the energy crisis; contends that these proposals should be considered within the confines of one standing committee which could sort through the proliferating number of environmental bills in a timely and workmanlike fashion.

2723. Ditton, R. B., and Goodale, T. I. (Eds.), *Environmental Impact Analysis: Philosophy and Methods*, Proceedings of the Conference on Environmental Impact Analysis, Green Bay, Wisconsin, 4-5 January 1972, 171 pp. (Available from Sea Grant Publications Office, 1225 West Dayton St., University of Wisconsin, Madison, Wis. 53706.)

Contains 16 chapters, 4 dealing with the National Environmental Policy Act (NEPA), the challenges it presents, and its impact; 2 chapters describe the implications of NEPA for the Federal Highway Administration and the Corps of Engineers, the problems they encountered in fulfilling its requirements, and their accomplishments along that line; other chapters consider such aspects as a systems approach to environmental impact, the dimensions of impact assessment, and procedures for making that assessment.

2724. Sullivan, F. E., Jr., and Schlesinger, W. H., "The Environmental Education Act: Where Do We Stand Now?", *BioScience*, v. 22, no. 6, June 1972, pp. 361-363.

Points out that environmental education must not only create an awareness of the interdependence of the ecology, but must also instill an understanding of that interdependence; emphasizes that development of this understanding hinges on the organization of effective environmental education programs; recommends assessment of existing environmental education programs, particularly those which resulted from federal funding of the Environmental Education Act of 1970; outlines the basic components of environmental education which must be improved – study sites, curriculum materials, and personnel – and suggests means for improving them; discusses reasons for the disappointing results of Environmental Education Act.

2725. Green, H. P., *The National Environmental Policy Act in the Courts (January 1, 1970 – April 1, 1972)*, The Conservation Foundation, 1972, 31 pp. (Available from The

Conservation Foundation, 1717 Massachusetts Ave., N.W., Washington, D.C. Price: $1.00.)

Describes the basic provisions of NEPA, and the manner in which these provisions may be enforced through privately initiated litigation, in the light of the existing body of judicial decisions; analyzes the emerging judicial interpretation of NEPA as revealed by court decisions.

2726. "The President's Environmental Legislative Program", *Congressional Record*, v. 118, no. 140, 11 September 1972, pp. S14476-14477.

Outlines the President's environmental legislative proposals covering 24 problem areas, describing the problems, and then discussing the proposed actions or legislation; proposals concern water quality, pesticides, noise, ocean dumping, and power-plant siting among others; lists legislation passed, such as the Clean Air Amendments of 1970 and the Oil Pollution Intervention Convention.

2727. Doub, W. O., "Environmental Law: A Challenge to the Legal Profession", *AEC News Releases*, v. 3, no. 34, 23 August 1972, pp. 6-10.

Describes the response of the legal profession to the environmental movement, which appears to have been more critical than constructive in dealing with these new problems; discusses the unique challenges to the legal profession posed by complex technical and environmental issues, particularly as they relate to the Atomic Energy Commission's licensing of commercial nuclear reactors; views environmental law as the new frontier of the profession, and deems it worthy of full attention, since decisions on environmental matters can affect the interests of many people.

EUROPE

2728. "European Cooperation for a Healthy Nuclear Industry?", *New Scientist*, v. 55, no. 813, 28 September 1972, p. 564.

Reviews remarks of Professor Heinrich Mandel, technical director of West Germany's largest electrical utility, in a talk before the British Nuclear Energy Society; Professor Mandel called for international harmonization of the legal aspects of nuclear energy, pointing out that differences in licensing procedures and safety regulations between countries hinder cooperation and could hold back European nuclear power companies; other views expressed include: "reduction of construction and capital costs must be the highest goal in reactor development"; "minimization of installation cost rather than fuel cost will be the key to success"; "the final aim [in establishing international cooperation] should be the creation of a multinational group" to cover all aspects of nuclear power.

2729. *Thirteenth Activity Report of the European Nuclear Energy Agency*, Organisation for Economic Co-operation and Development, December 1971, 92 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006.)

Summarizes the activities of the ENEA in 5 broad areas (joint undertakings and common services, nuclear power, scientific and technical cooperation, health and safety, and legal affairs); highlights include: initiation of a study, under the Halden Project, to develop advanced computer control systems for power reactors under transient conditions; establishment of a 20-nation cooperative program for wholesomeness testing of irradiated foods; and completion of a study on radioactive waste management practices in Western Europe [*SPR* 5(2): 2557].

2730. Pavitt, K., "Technology in Europe's Future", *Research Policy*, v. 1, no. 3, July 1972, pp. 210-273.

Considers Europe's failure to achieve fullest utilization of its resources in "strategic" technological sectors: communications, aerospace, and energy; reviews the present status of technological R&D in Europe, and identifies the technological-development alternatives for the future; outlines the key political issues that must be resolved to gain acceptance of a much greater degree of technological integration among European countries; suggests that through technological integration European firms should become competitive in world markets in

nuclear energy, telecommunications, and emerging technologies to meet social needs such as transportation, medical care, and education; expresses doubt, however, concerning Europe's ability to gain parity with the U.S. in aerospace technology.

2731. "A Common R&D Policy", *Nature*, v. 237, no. 5357, 30 June 1972, p. 476.
Describes new European Commission proposals for a European R&D policy which will enable the European Community to compete effectively with huge U.S. companies, and which includes the establishment of a European Research and Development Committee and a European Science Foundation.

2732. "The European Community's Technological Policy", *Embassy of Switzerland Bulletin*, v. 12, no. 2, July 1972, pp. 32-34.
Presents excerpts from a statement by a member of the European Communities which calls for improved means of international cooperation and for establishment of a joint scientific and technological policy within the European Community; emphasizes the need for collective consideration of priorities, and for financial instruments to assure adequate support for priority projects requiring joint funding; describes the EEC Commission's proposals for meeting these needs – establishment of a European Research and Development Committee and a European Agency for Research and Development.

2733. Sherwood, M., "An Umbrella for European Science", *New Scientist*, v. 55, no. 803, 6 July 1972, pp. 19-20.
Describes plans of the European Economic Community Commission to develop a joint science and technology policy for Europe; according to the Commission, such a policy should have 4 aims: extension of scientific and technical knowledge, social advance, development of advanced technologies for economic ends, and the mastery of progress; plans call for the establishment of a European Research and Development Committee and a European Research and Development Agency to advise the Community as to which projects to back and to handle the implementation of Community decisions on scientific and technological collaboration.

2734. "COMECON Meeting", *Nature*, v. 238, no. 5359, 14 July 1972, pp. 65-66.
Discusses changing trends in COMECON activities concerning the technological and scientific integration of the Eastern European bloc, which until recently took the form of specific projects, but now takes the form of creating specific organizations to deal with wide-ranging problems of interest to the entire COMECON bloc; describes financial problems facing COMECON, and the support necessary to exploit Soviet raw material resources for distribution to other countries of the bloc.

FORECASTING

2735. Gordon, T. J., and Becker, H. S., "The Cross-Impact Matrix Approach to Technology Assessment", *Research Management*, v. 15, no. 4, July 1972, pp. 73-80.
Describes a relatively new forecasting technique which can be used to predict and examine the effects of interactions between different types of possible future events – a cross-impact matrix; this forecasting technique provides a model useful in testing policies designed to improve or diminish the probability of events associated with a given innovation or technology.

2736. Bright, J. R., "Technology Forecasting – New Tools for an Old Responsibility", *Research Management*, v. 15, no. 4, July 1972, pp. 50-65.
Describes and evaluates major technology forecasting methods: trend extrapolation, monitoring, goal oriented (or normative) forecasting, simulation, scenarios, and cross-impact analysis; stresses the need for better understanding of the technological innovation process and for improved tools for decision making on the technological future; outlines the benefits of technological forecasting to industrial organizations: provides sounder and more complete data for managerial decisions, forces consideration of the technological aspects of the organization's activities, and serves as a communications device for the organization.

2737. Martino, J. P., "Technological Forecasting Is Alive and Well in Industry", *The Futurist*,

v. 6, no. 4, August 1972, pp. 167-168.

Discusses efforts of three industrial and technological firms to maintain and strengthen their technological forecasting and planning activities, despite the recent business recession, and identifies the reasons for their success; points out that the common element in these three cases is the "recognized utility of the forecasts", i.e., the firms' decision makers have recognized the specific utility of each forecast to the firms' overall activities, and therefore, the value of the firms' forecasting and planning groups; suggests that when these groups demonstrate relevance, their work is more likely to be accepted by high management.

2738. "Common Market to Promote Use of Technological Forecasting", *Inside R&D*, v. 1, no. 12, 21 June 1972, p. 2.

Describes plans of the Common Market (CM) to aid medium-sized companies in using technological forecasting, which may include assistance to firms in making their own forecasts (with the CM possibly furnishing classified and evaluated information), or providing firms with actual forecasts; identifies the most important types of forecasts, as determined by a CM-instituted study: (1) specific forecasts concerning products and processes of a particular company, and (2) overall forecasts covering the industry to which a particular company belongs; notes the only minor efforts in the U.S. toward providing assistance to industry in this area.

2739. *The Alternative Futures Project at the University of Illinois*, Newsletter No. 2, January 1972, 8 pp. (Available from Alternative Futures Project, University of Illinois, Urbana, Ill. 61801.)

Presents abstracts of papers written during 1971 or descriptions of work now in progress under the Alternative Futures Project; research efforts have been focused chiefly on the possible uses of new communications technology; other studies have dealt with such subjects as: the teaching computer as a mediator among groups with different viewpoints, the advantages and disadvantages of involving a larger portion of the public in the planning process, and the idea of an electronic world university.

FOREIGN AFFAIRS

2740. Wu, L. N., *The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age*, Science, Technology, and American Diplomacy Series, prepared for the U.S. House of Representatives' Foreign Affairs Subcommittee on National Security Policy and Scientific Developments, 1972, 67 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 30 cents.)

Presents a brief historical overview and an explanation of the political, military, and technical factors of the atmosphere in which international negotiations on the control of atomic energy took place; identifies 3 basic issues prominent in the U.S. policymaking process and in the negotiations: (1) the form and purposes of international control, (2) the stages of transition to international control, and (3) enforcement — sanctions and the veto; explores these issues to show the interaction of technological and diplomatic factors, and how this interaction affected the outcome of each issue; concludes that only a combination of the elements from science, technology, and diplomacy could be expected to devise a workable system for control that would be acceptable to the world's leading nations.

FRANCE

2741. "French Pursue Transport Market", *Aviation Week & Space Technology*, v. 97, no. 4, 24 July 1972, pp. 31-33.

Reviews the history of the French aerospace export industry, and describes specific examples of French aerospace products; discusses France's soon-to-be-completed development of 3 major aircraft programs which are aimed at specific sectors of the world civil aircraft market and designed to shift the balance of both domestic and export sales — now predominantly military — to an equal split between military and civil products.

GOVERNMENT-SCIENCE INTERACTION

2742. Armin-Arsala, B., "The Making of Science Policy – By the Numbers", *sppsg Newsletter*, v. 3, no. 6, June-July 1972, pp. 1-2.

Examines the implications for the National Science Foundation arising from the new wording in the House authorization bill for FY 1973 (H.R. 14108); notes that according to one current interpretation, if the House version survives conference, the NSF will be forced to spend many more million dollars than it intended in several areas even though appropriated funds are not as high as those authorized; presents figures which point up the issue, and describes NSF concerns that the shortfall will have to be deducted from the RANN and "Scientific Research Project Support" areas; includes a tabulation comparing the new funding requested by the NSF, the figures contained in the Administration budget, and the funds authorized by the Senate and House.

2743. "NSF Authorization and Appropriation: A Sequel", *sppsg*, v. 3, no. 7, August-September 1972, p. 11.

Reports that the troublesome (for NSF) wording in the House authorization bill was corrected before the bill was enacted (Ref. 2742); the new funding appropriated is $619 million, to which can be added $38.2 million in carry-over funds and foreign currency, with the carry-over funds being released for general purposes rather than being restricted to education categories; since the Appropriation Act calls for the NSF to spend $13 million for science education and institution science programs above the President's budget request for those activities ($19 million), the NSF will have to take almost $32 million from its planned budget in other areas – i.e., from research support.

2744. "National Science Policy and Priorities Act of 1972", *Congressional Record*, v. 118, no. 133, 17 August 1972, pp. S13868-13885.

Presents the text of Bill S. 32, to authorize the National Science Foundation to conduct research, education, and assistance programs to prepare the U.S. for conversion from defense to civilian, socially oriented R&D activities; the bill carries provisions for identifying science policies and priorities for civilian research and engineering, design and demonstration of civil science systems, transition of technical manpower to civilian programs, and protection of pension rights to scientists and engineers, along with a number of general provisions.

2745. "Kennedy Science Measure Receives Senate Approval", *Washington Science Trends*, v. 28, no. 20, 21 August 1972, pp. 115-117.

Announces the Senate's approval of the National Science Policy and Priorities Act which calls for the NSF to identify priorities for civilian research in such problem areas as health care, pollution, housing, education, and transportation, and provides funds ($50 million over a 3-year period) for NSF's conduct of about 100 research projects to advance the state of the art in such areas; the act also would establish a Civil Science Systems Administration to apply science, technology, and advanced analytical techniques to the design testing, evaluation, and demonstration of projects, primarily those which can improve public projects; additionally, the legislation provides funds to aid states, communities, companies, and individual scientists, engineers, and technicians in making the transition to civilian programs. (Single copies of the Act and related hearings may be obtained from the Office of Sen. E. M. Kennedy, Old Senate Office Building, Room 431, Washington, D.C. 20510.)

2746. Schultze, C. L., et al., *Setting National Priorities: The 1973 Budget*, The Brookings Institution, Washington, D.C. 20036, 1972, 468 pp. ($3.95 paperback.)

Analyzes the budget proposed for FY 1973, focusing on 3 major areas (defense, civilian programs, and the environment); *Defense:* identifies the key decisions that shaped the 1973 defense budget, examines the major elements of military forces and defense costs, and discusses alternative policies; *Civilian Programs:* examines such programs as income support, health insurance, and child care, the Federal role in easing fiscal problems of cities, and Federal assistance to local school districts; *Environment:* deals with environmental problems, and compares two alternative approaches to pollution control – regulation versus economic incentives; concludes with a dicussion of tax policies and budgetary procedures.

2747. Holmfield, J. D., "Science Policy and National Priorities", *sppsg Newsletter*, v. 3, no. 6, June-July 1972, pp. 6-7.

Offers a strong critique of the Brookings Institution team's analysis of the proposed 1973 Federal Budget (Ref. 2746); chief objections are the study's (1) notable lack of balance; (2) neglect of the problem of R&D priorities; (3) total lack of discussion of the role of science and technology (particularly in the analysis of the defense budget and the discussion of the environmental program); and only brief mention of defense R&D policy; also takes issue with suggestions for data gathering and experimentation in the analysis of the social program, charging that they reflect a lack of awareness of on-going social research; agrees, however, that the Brookings analysis of defense policy is useful in that it includes an analysis of the relationship between foreign policy goals and defense policy which indicates national science policy can *indeed* be derived from broad national goals.

2748. "Social Science 'Relevance' ", *Washington Science Trends*, v. 28, no. 13, 3 July 1972, p. 75.

According to L. H. Silberman, Undersecretary of Labor, the Nixon Administration is placing emphasis on relevance in its social science R&D studies, favoring development of sound and well conceived programs over "pie in the sky" approaches in the fields of labor and manpower; warns against personal policy bias on the part of researchers if they hope to find government responsive to their work, and calls for synthesization of research results.

2749. Goldman, J. E., "Toward a National Technology Policy", *Science*, v. 177, no. 4054, 22 September 1972, pp. 1078-1080.

Contends that the U.S. has given far too little support to the creation of new technologies and has failed to alter its technical priorities to confront the enormous changes the world is undergoing; emphasizes the importance of a systems approach to assessing needs, defining goals, mustering talents, and creating markets in today's context; cites statistics and examples of overwhelming emphasis on noncivilian Federal programs, sluggishness in Government response to new social goals, and misplaced priorities in the public/civilian sector; urges that a national technology policy include periodic reassessments of objectives as changes are effected.

2750. "RANN: Growth at NSF Stirs Concern, but . . .", *Science and Government Report*, v. 2, no. 10, 15 July 1972, pp. 1-4.

Assesses the validity of criticisms of RANN and the concerns over NSF's supposedly extensive preoccupation with applied research, pointing out that the sum allotted to RANN represents only 12.3 percent of NSF's total budget; describes RANN's research efforts which are focused on 3 problem areas: energy, municipal systems, and regional environmental programs; concludes that "RANN is emerging as a cautious and fairly reasonable response to widespread interest in 'relevant' research", and should be viewed as nothing other than a "threat to obsolete ways of relating science and government".

2751. Salomon, J.-J., "The Mating of Knowledge and Power", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 123-132.

Describes the increasing interdependence of science and politics, with government perceiving science as "national capital . . . an indispensable tool in the very exercise of government", and science finding it increasingly difficult "to dissociate its operations from their social consequences" and no longer possible to "profess indifference to the political uses that are made of their discoveries"; discusses the dilemmas this interdependence poses for both scientists and government, the true role of science in policy making, and the dependence of scientists on government financial support which makes them a tool of government.

2752. "Development of Nonchemical Means of Insect Control", *Inside R&D*, v. 1, no. 12, 21 June 1972, p. 3.

Reports the award of $900,000 to 15 state experimental stations for research on nonchemical insect-control techniques; notes the unwillingness of industry to spend research dollars in this area, and suggests that the funding of this research by the Cooperative State Research Service, part of the U.S. Department of Agriculture, will foster continuation of this trend.

2753. Magruder, W. M., "Technology and the Professional Societies", *Mechanical Engineering*, v. 94, no. 9, September 1972, pp. 9-15.

Reviews the technological trends in the U.S., and cites statistics from the National Budget for 1973, noting in particular that 45% of the budget will be for domestic programs and that $40 million is earmarked for incentives to stimulate innovation, inventions, and transfer of technology; outlines incentives offered by other nations, and U.S. actions to stimulate technology; stresses the need for improved communications between the technical and engineering communities and U.S. policy makers, and offers suggestions as to the responsibilities of technical societies and the actions they can take to establish effective communication; emphasizes the importance of a strong technology base in attaining national goals and in solving societal problems.

2754. McEvoy, J., III, "Multi- and Interdisciplinary Research – Problems of Initiation, Control, Integration, and Reward", *Policy Sciences*, v. 3, no. 2, July 1972, pp. 201-208.

Describes some of the difficulties of initiating and completing interdisciplinary, cross-systems research; discusses the structural mechanisms which may limit the role of universities in research efforts of this type, and offers specific suggestions for the conduct and design of interdisciplinary research projects; examines the political implications of recent changes in national science policy.

2755. Lewis, H. J., "The Science Advisory System Faces a Sudden Challenge", *sppsg Newsletter*, v. 3, no. 6, June-July 1972, pp. 4-6, also *NAS/NRC/NAE News Report*, v. 22, no. 7, August-September 1972, pp. 4-5.

Assesses the possible ramifications of Executive Order 11671 (June 7, 1972) which stipulates that all external advisory committees established by federal agencies are subject to provisions that could end the confidentiality of their meetings – i.e., that all meetings shall be open to the public, subject to certain exceptions; outlines the most pertinent of the 9 exemptions: (1) national security and foreign policy, (2) proprietary information, and (3) matters of personal privacy; describes the reactions of the various government agencies and their approach to the order, with HEW deciding for itself which meetings shall be closed to the public, and NASA temporarily suspending advisory committee meetings, awaiting clarification, but cautioning against overreaction by the scientific community.

2756. "Changes Expected in White House Office of Science and Technology", *Inside R&D*, v. 1, no. 23, 6 September 1972, p. 4.

Notes the Nixon Administration's disenchantment with the White House Office of Science and Technology, recently intensified by the OST's failure to act quickly and efficiently to take advantage of growing ties with the Soviet Union and China; predicts changes in both structure and personnel, if President Nixon is reelected, with more business men and technical people manning the various posts; suggests that the new group would have more knowledge of industrial R&D problems and be more likely to devise solutions agreeable to industrial R&D managers.

2757. Shapley, D., "Roster of Top Science Committee Posts Filled", *Science*, v. 177, no. 4049, 18 August 1972, p. 590.

Reports the appointment or reappointment of 21 members to the President's Science Advisory Committee, the National Science Board, and the President's Committee on the National Medal of Science, who balance out academic disciplines, industry and university representation, and, in the case of the NSB, geographic distribution; describes efforts to upgrade and glamourize the National Medal of Science awards.

2758. *Federal Funds for Academic Science: Fiscal Year – 1970*, National Science Foundation NSF 72-301, December 1971, 62 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents.)

Tabulates and discusses FY 1970 Federal obligations, as compiled by the National Science Foundation for the Committee on Academic Science and Engineering (CASE); presented in 2 parts: I–Total Federal Academic Science Support (in terms of type of activity, source of funds, field of science, and distribution of funds), field of science, and distribution of funds); and II–Major Types of Federally Funded Academic Science Activities (R&D, facilities and equipment, and

science education).

2759. *Grants for Education in Science: A Guide to Policies and Procedures,* National Science Foundation Report NSF 72-7, 1972, 42 pp. (Available from Distribution Section, National Science Foundation, Washington, D.C. 20550.)

Describes the types of educational activities supported, gives general instructions for submission of proposals, and provides information on the financial support of projects.

2760. *National Science Foundation Grants and Awards 1971,* 250 pp. (Available from the U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.50.)

Provides a detailed listing of grants and contracts covering research project support; basic research support for science and computing activities in education; specialized research facilities and equipment support; national research centers; national, international, specialized research and sea grant programs; science information services; and science education support.

2761. Bickner, R. E., "Science at the Service of Government: California Tries to Exploit an Unnatural Resource", *Policy Sciences,* v. 3, no. 2, July 1972, pp. 183-199.

Examines California's efforts to utilize science and systems analysis as aids in formulating public policy; reviews the potentialities and limitations of each of the four alternative sources of scientific and analytic assistance under consideration: profit-seeking firms, not-for-profit research organizations, universities, and in-house scientific staffs or advisory boards.

2762. Holloman, J. H., "Technology in the United States: The Options Before Us", *Technology Review,* v. 74, no. 8, July/August 1972, pp. 32-42.

Briefly summarizes the issues outlined in the first installment of this essay [*SPR* 5(2): 2335], which made clear the need for revision of U.S. policies relating to technology and its use in society, and for a better understanding of the effects of R&D policy to assess future alternatives; assesses the options for making more effective use of technology in society: (1) Take No Specific New Actions; (2) Directly Support Private Technical Effort; (3) Indirectly Support Private Technical Efforts; (4) Improve the Services Sector; (5) Support Training and Relocation of Displaced Workers; (6) Support High-Risk Ventures; (7) Improve the Transfer of Technology; and (8) Ameliorate the Consequences of Technological Change.

2763. Miller, G. P., "Intergovernmental Science and Technology", *Congressional Record,* v. 118, no. 113, 20 July 1972, p. H6792.

Describes the accomplishments of a 3-day National Action Conference on Intergovernmental Science and Technology Policy held during June in Harrisburg, Pa., convened for the purpose of formulating recommendations for workable policies, institutional arrangements, and action plans to promote the application of science and technology to public, domestic programs; the most tangible accomplishment was the reaching of a consensus on specific resolutions for action (expected to be published shortly).

2764. *Nonlethal Weapons for Law Enforcement: Research Needs and Priorities,* A Report to the National Science Foundation by Security Planning Corporation, March 1972, 68 pp. (Available from Security Planning Corporation, 1225 19th St., N.W., Washington, D.C. 20036.)

Examines the problems and policy issues concerning nonlethal weapons, and outlines R&D priorities; recommends that chemical and electrical weapons (which offer the greatest promise in the short term) be given the highest priority; weapons discussed include nausea-producing aerosol sprays, agents which can create psychological disorientation in crowds, the electrical baton, and the "Taser" which fires barbed contactors that deliver immobilizing low-energy pulsed shocks.

HEALTH AND SAFETY

2765. "Detrick Unveiled", *Nature,* v. 237, no. 5357, 30 June 1972, p. 480.

Presents details of research planned by Litton Bionetics Inc., who contracted to operate the research center at Fort Detrick for the National Cancer Institute; initial functions to be carried out include the large-scale production of tumor

viruses and the preparation and analysis of chemical carcinogens for use in biochemical and immunological studies, with straightforward cancer research to be undertaken at a later stage.

2766. "Health Sciences Program Gets $5m Shot in the Arm", *Physics Today*, v. 25, no. 8, August 1972, p. 71.

Announces the award of a 5-year grant to the Harvard-Massachusetts Institute of Technology by the National Heart and Lung Institute for a multidisciplinary program of research on biomedical materials; describes the research to be conducted, which ranges from basic research to applications of research findings to actual health services, and lists participants in each category of research involved.

HOUSING AND CONSTRUCTION

2767. "Low-Cost Rural Housing Development Program", News Release from Battelle's Columbus Laboratories, 10 August 1972, 4 pp.

Announces the initiation of a low-cost rural-housing development program (the Basic Homes Program), with a funding of $4.7 million; the overall goal is to investigate the feasibility of developing basic homes acceptable and affordable by low income rural families; Battelle-Columbus, prime contractor on the research, is seeking participation from all facets of the home building industry; the design of the experimental units will be based on a market assessment of these families' needs, and the price per unit is to range from $7500 – $13,000. (Additional information on the request for proposal may be obtained from J. H. Hagely, Battelle's Columbus Laboratories, 505 King Ave., Columbus, Ohio 43201, telephone 614-299-3151; all proposals for potential subcontractors must be submitted by November 1, 1972.)

INDIA

2768. *National Science Policy and Organization of Scientific Research in India*, Science Policy Studies and Documents, Unesco, no. 27, 1972, 129 pp. (Available from Unesco Publications Center, P.O. Box 433, New York, N.Y. 10016. Price: $2.50.)

Presents the historical background of scientific research in India, and describes the organization and financing of scientific and technical research; presents data on scientific and technical manpower; outlines the principal aims of India's science policy; describes the political structure, and presents basic socioeconomic data (geographic features, population, mineral resources, and economic structure); includes 13 annexes listing, for example, Indian Universities, scientific societies, national laboratories, government and private research institutions, and presenting the Indian Government's Scientific Policy Resolution, as well as a bibliography.

2769. "Indian Science", *Nature*, v. 238, no. 5358, 7 July 1972, p. 2.

Criticizes a report on the organization of scientific research in India *(National Science Policy and Organization of Scientific Research in India*, Ref. 2768), charging that it avoids those issues which at present preoccupy not merely the government but those in India who work or aspire to work in scientific research: too few opportunities for research, too little money, and bureaucratic restraints; views the recognition of the need for change by the Indian Government and research institutions as an indication that conditions will improve.

2770. Seshachar, B. R., "Problems of Indian Science Since Nehru", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 133-141.

Describes the surge in scientific activity in India after independence, with the number of universities tripling from 1947 to 1972, and with the establishment of the Council of Scientific and Industrial Research, the Department of Atomic Energy, and other government research agencies; outlines the aims of India's science policy and discusses the economic and social constraints to implementation of that policy; points out that science in India is largely governmental science administered by the government, and that there is a lack of communication between scientists and government and among scientists themselves; notes the marginal role of scientists in the formulation of government policies, and stresses

the need for government recognition of the role of science in nation building.

2771. *Proceedings of the Third National Conference of Scientists, Technologists, and Educationists, New Delhi, India, November 28-30, 1970*, National Committee on Science and Technology, 1972, Vol. I, 79 pp. (Available from National Committee on Science and Technology, Department of Science and Technology, R.B.I. Building, New Delhi, India.)

Presents the Scientific Policy Resolution adopted by the Indian Government in 1958, and describes the focus of the Conference — a preliminary report on the implementation of that resolution as well as a number of basic issues raised by the report; includes a Conference Report which outlines views and recommendations on a national science policy, the organization and management of scientific agencies and laboratories, R&D and industrial research, and higher education and manpower; also includes the addresses given at the Inaugural Session, a report of the Working Groups, and the Conference agenda.

2772. Sarabhai, V., "India and the Green Revolution", *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 8-10.

Describes the impact of the "Green Revolution" on employment, the relative distribution of income, and the resultant trend toward mechanization; discusses the need for tube wells to supply water where surface irrigation is not possible, the resulting need for low-cost power to energize the wells, and the Indian Atomic Energy Commission's proposal to build two nuclear power stations to supply the power needed; examines the problems involved in implementing a tube well/nuclear power plant complex, which will require a vast effort — by the national government, state and local governments, industry, and private individuals.

INFORMATION MANAGEMENT

2773. "NOAA Forms New Facility for Earth-Sun Data", *U.S. Department of Commerce News*, Release NOAA 72-98, 28 July 1972, 2 pp.

Announces the establishment of the National Geophysical and Solar-Terrestrial Data Center as part of NOAA's Environmental Data Service; primary data from national and worldwide sources, as well as special data publications, are to be made available through the Center at "nominal" cost; also available will be geomagnetic activity indices, charts of geomagnetic field components, compendia of U.S. earthquakes, and interdisciplinary summaries of solar-terrestrial phenomena. (For further information contact NOAA Environmental Data Service, D6, Boulder, Colo. 80302.)

2774. "Second Thoughts on Science Information Exchange", *Inside R&D*, v. 1, no. 10, June 7, 1972, pp. 3-4.

Reports reevaluation of the operation of the Smithsonian Institution's Science Information Exchange to determine the advisability of closing it, an action earlier under consideration; also reports comments of officials in Federal laboratories made during a Government Accounting Office survey, all leading to the consensus that the Exchange is not only needed by industrial and governmental laboratories but its mission should be expanded to get the most out of everyone's research dollar.

INTERNATIONAL SCIENCE ACTIVITIES

2775. Handler, P., "Opportunities for U.S.-U.S.S.R. Joint Scientific Ventures", *sppsg Newsletter*, v. 3, no. 6, June-July 1972, pp. 8-10.

Presents excerpts from testimony before the Subcommittee on International Cooperation in Science and Space of the Committee on Science and Astronautics, House of Representatives, June 14, 1972, which addressed the question of "whether there are indeed meaningful, 'mutually beneficial' opportunities for joint ventures by American and Soviet scientists and engineers"; suggested areas for joint efforts included studies of various aspects of the Arctic; various investigations in the fields of medicine and public health, social science, and earth sciences (which offers many possibilities); and efforts to develop new energy sources; urges

identification of the costs of "a substantial program in implementation of the Moscow accords", and supplemental appropriations to support those activities to be initiated in FY 1973.

2776. Lewis, H. J., "The Soviet Agreement: How It Was Put Together", *sppsg*, v. 3, no. 7, August-September 1972, pp. 1-4.

Discusses the follow-on activities to the U.S.-U.S.S.R. Agreement on Cooperation in the Fields of Science and Technology (signed May 24, 1972), the most recent of which was the meeting of the Joint Commission on Scientific and Technical Cooperation, held in Washington, D.C., in late October; the Commission convened to consider proposals for cooperative undertakings in a wide variety of technical fields; working groups have been established in the fields of energy research and development, agriculture, computer application in the field of management, water resources, microbiology, and chemical catalysis, and Soviet financial and technical participation in the U.S. deep-ocean drilling research program is anticipated.

2777. Lyons, R. D., "U.S. and Soviet Will Lead A 12-Nation 'Think Tank'", *New York Times*, 5 October 1972.

Presents details of The International Institute of Applied Systems Analysis set up by scientific academies of a dozen nations to seek solutions to problems created by the increasing industrialization of societies; the U.S.S.R. and U.S. will each provide one-third of the annual operating costs of about $3.5 million, the remaining third coming from other nations; according to the National Academy of Sciences, "projects being considered for the Institute fall into four major categories – environmental systems, health care systems, municipal services systems, and large engineering design systems"; "A likely first task would be . . . an analytical study of short- and long-range projections of world supply of energy resources and demands for energy . . . dynamic substitutions among energy sources . . . and hazards of each source".

2778. *Cooperative Science Programs*, National Science Foundation, 1972, 8 pp. (Available from East Europe Cooperative Science Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.)

Provides information on a new program offered by the National Science Foundation to foster and support scientific and technological cooperation between the U.S. and Bulgaria, Czechoslovakia, Hungary, and Romania; covered are scope, eligibility, types of activities (cooperative research, joint seminars, scientific visits), financial-support arrangements, and proposal preparation.

2779. "Tangible Benefits From International Scientific Exchange", *International Science Notes*, no. 28, September 1972, pp. 2-4.

Assesses the benefits accruing to the U.S. from scientific exchange with foreign countries; these include, for example, direct economic benefits stemming from avoidance of duplicatory efforts; trade offs resulting from collaborative research; utilization of facilities in other countries which would be costly to duplicate in the U.S.; increased demand for U.S. equipment, sophisticated instrumentation, technological training, etc., stimulated by cooperation in scientific and technological areas (e.g., nuclear power plants); breakthroughs in medical research; and improved weather forecasting.

ISRAEL

2780. Keynan, A., "The Science-Government Relationship in Israel", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 157-174.

Describes the origins of Israeli science, the present size and institutional framework of science, and Israel's science policy bodies, particularly the National Council for Research and Development which was given broad responsibilities; discusses the problems which have confronted both science and government in the past and those confronting them at present; sets forth the reasons for scientists' reluctance to serve as advisors to the government, and stresses the need for improved communication between the scientific community and government decision-making bodies.

2781. Farago, P., "Israeli Notebook", *New Scientist*, v. 55, no. 803, 6 July 1972, pp. 41-42.

Describes the organisation and operation of Israeli civil R&D which has, for the past 3 years, fully incorporated the customer/contractor principle recently advocated by Lord Rothschild as a basis for the U.K.'s conduct of research; points out that there are few indications of advantages through the use of this principle that would not have been obtained otherwise, and that its use in Israel is still only a partial success.

JAPAN

2782. *Technological Development in Japan*, A case study prepared by the Japanese National Commission for Unesco, 1971, 156 pp. (Available from Unipub, Inc., P.O. Box 433, New York, N.Y. 10016. Price: $3.50.)

Contains 5 chapters, the first describing the historical background of Japan's industrial development since 1868, and the others dealing successively with the development of industrial technology, various aspects of Japanese national policy affecting development, the influence of economic conditions, the training and deployment of manpower, and questions of management and leadership in industry.

2783. Findeis, A. F., "Graduate Education in Science and Engineering in Japan", *Science*, v. 177, no. 4049, 18 August 1972, pp. 583-588.

Provides data on graduate education in Japan to serve as the basis for comparison with U.S. graduate education, which reveal that there is more diversity among the types of degrees awarded in Japan, that national universities dominate the graduate education scene, and that research is concentrated in national universities and in the associated research institutes; lists statistics (1957-1968) on the number of doctorate degrees awarded in science and engineering, on doctoral production in the sciences by area of study, and on enrollment in the national universities offering graduate education to the doctorate level; presents a hypothetical budget comparing U.S. and Japanese funding support.

2784. "Notes on Japanese Science", *International Science Notes*, no. 28, September 1972, pp. 14-15.

Presents the salient points of two White Papers, one on science and technology and the other on the environment, issued by the Japanese Government late last spring; *On Science and Technology:* describes Japan's 3 major problems, viz., the need to continue development of new technologies (and thus decrease dependence on foreign creative capabilities), the need to develop a technology assessment system in Japan, and proper allocation of resources to meet national needs; *On the Environment:* deals with both pollution and conservation, pointing out that "environmental pollution can no longer be viewed as a necessary evil of economic development"; discusses the need for conservation of natural resources and better land use.

MANAGEMENT OF SCIENCE

2785. Macdonald, J. R., "Federal Laboratories and National Policy", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 10-11.

Calls for reassessment of U.S. national laboratories and describes their common problems, such as inadequate infusion of young professionals, outgrowing viability, and mission overlap; discusses the growing need to adopt new modes of organization and support, to forego completely undirected basic and fundamental research, and to establish new priorities for resource allocation; suggests that more effort be directed to social problems, and argues for "a system of laboratories better organized to help meet pressing national and worldwide needs".

2786. Fusfeld, H. I., "What is the Role of Basic Research in Industry?", *Research Management*, v. 15, no. 4, July 1972, pp. 26-32.

Offers suggestions for maximizing the effectiveness of the basic researcher, emphasizing the need for the scientist to determine the usefulness of each basic research program, identify potential users, and take actions to assure that the results of the research are put to use; questions the usefulness of placing research activities under separate categories of basic research, applied research, develop-

ment, or engineering, pointing out that the present trend is toward a blending of activities from research into a complete system.

2787. "The Changing Emphasis in Industrial R&D", *R&D Management*, v. 2, no. 3, June 1972, pp. 145-146.

Presents the principal observations and conclusions reached at a conference held to discuss the changing emphasis in industrial R&D (European Industrial Research Management Association Conference, Paris, France, March 1972): (1) R&D is subject to the same pressures as the rest of the company when there are cash-flow problems; (2) many established R&D managers, developed in an expanding research climate, have difficulty in adapting to current circumstances; (3) the growing concern with the protection of the environment must be taken into account in the planning and execution of R&D; (4) there is increasing pressure on R&D departments for the production of immediate and highly profitable developments; (5) changes in the American research climate are having a significant impact in Europe; and (6) there is no excuse for carrying out R&D if the results can be bought more cheaply elsewhere.

2788. Brown, A. E., "New Definitions for Industrial R&D", *Research Management*, v. 15, no. 5, September 1972, pp. 55-57.

Presents definitions of three newly named major categories of R&D activities performed in industrial research laboratories; these categories and definitions were proposed by a Industrial Research Institute committee; briefly, they are as follows: *Support of Existing Business Research* – that conducted in direct support of the given company's existing business to maintain or improve its profitability, and to improve its social acceptance; *Exploratory Research* – that performed for the purpose of advancing knowledge of phenomena of general company interest and also for finding major new high-risk business projects; *New High-Risk Business Project Research* – that conducted with the intention of developing a product, process, or market in which the sponsoring company has no direct manufacturing or market experience, or both.

2789. Maddox, J., "A Year of Transition for Basic Science", *Nature*, v. 239, no. 5366, 1 September 1972, pp. 13-14.

Surveys briefly the important advances in scientific research made over the past year, in fields such as astronomy, biomedica, and immunology; discusses last year's problems and controversies over research councils, university support, and excess of Ph.D.'s; examines the factors bringing research institutes and universities closer together, and describes the benefits of these closer ties.

2790. Fry, F. H., "Six Differences Between Long-Range and Development Labs", *Research Management*, v. 15, no. 5, September 1972, pp. 64-70.

Compares the objectives, customs, and methods of operation of long-range and development laboratories, and outlines the sharp contrasts and the underlying reasons for them; these contrasts are most apparent, for example, in the degree of technical sophistication of a concept required, in the complexity of the systems to be dealt with, in the type of effort required (individual versus group effort), in the time scale for completion of a project, and in the goals and attitudes toward process changes.

2791. Cellarius, R. A., and Platt, J., "Councils of Urgent Studies", *Science*, v. 177, no. 4050, 25 August 1972, pp. 670-676.

Contends that new mechanisms and institutions are needed to cope with crises such as nuclear war, pollution, and population, and to deal with problems before they become crises; suggests establishment of national and international coordinating councils of urgent studies to identify the urgent problems and types of research needed, encourage well-qualified scientists to undertake that research, help assemble task forces with the right mix of different specialties to work together on the same problems, and help those interested in such research to locate funding sources; outlines the possible organization of these councils on university, national, and international levels.

2792. *The Research System: Volume I, France, Germany, United Kingdom*, Organisation for Economic Co-operation and Development, 1972, 258 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C.

20006. Price: $7.00.)

Compares the organization of scientific research in France, Germany, and the U.K.; describes the varied ways in which these countries approach similar objectives, and the diversity of the institutions that have emerged; reveals that, in Europe, a great chasm exists between the university scientist and his industrial counterpart, and concludes that the greater success of the U.S. in fundamental research and innovation stems from the entreprenurial spirit of American Universities; studies of Belgium, the Netherlands, Norway, Sweden, Switzerland, are to follow, as well as a comparison of the organization of research in the U.S., Canada, and Japan on the one hand and Europe on the other.

2793. Block, R. G., "R and D Resource Allocation – a Quantitative Aid", *Research/Development*, v. 23, no. 8, August 1972, pp. 20-24.

Describes a quantitative evaluation system which can help R&D managers, faced with limited budgets as well as proposed programs of widely varying potential payoffs, stages of advancement, and resource requirements, in decisions on proper allocation of funds among their various projects, and concerning which efforts should proceed and which should be dropped or delayed.

MANPOWER – TECHNICAL AND SCIENTIFIC

2794. "Initial PEP Activities Involve Four ACS Staff Departments", *Chemical & Engineering News*, v. 50, no. 30, 24 July 1972, p. 60.

Describes the functions of 4 American Chemical Society departments under the Society's Professional Enhancement Program; Membership Activities Department providing free employment information and advice; the Department of Chemistry and Public Affairs handling government and public affairs programs; the Department of Professional Relations and Manpower Studies dealing with professional services; and the Department of Public and Member Relations conducting public information programs.

2795. "New Jobs for Defense and Aerospace Engineers and Scientists?", *Inside R&D*, v. 1, no. 18, 2 August 1972, p. 3.

Cites claims of the U.S. Department of Labor that 55,000 jobs exist (in such industries as food, chemicals, pollution control, and ocean engineering) which could be filled by unemployed scientists and engineers; outlines 2 major problems (according to DOL) in matching openings with job seekers: to get industries to recognize their need for technical assistance, and to persuade the aerospace/defense unemployed of their need for skill conversion; contends that DOL overlooked the true problem, and offers in support a profile of unemployed scientists and engineers (annual salary, under $15,000; age, ~50% 35 to 49 and 37% over 50; education, 50% with less than a B.S. degree); claims that, in truth, industries are not hiring many scientists and engineers.

2796. *Unemployment Rates and Employment Characteristics for Scientists and Engineers, 1971*, National Science Foundation Report NSF 72-307, 193 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.75.)

Presents the detailed data compiled from unemployment surveys made last spring, the preliminary results of which were reported in NSF 71-26 and 71-33 [*SPR* 4(3): 1088 and 1089]; results are tabulated by field of specialization, by subfield, by highest degree, age group, and geographical area; also tabulated are percentages of scientists and engineers employed in positions outside their respective fields.

2797. "Engineering Manpower Outlook", *Inside R&D*, v. 1, no. 24, 13 September 1972, pp. 3-4.

Reports a prediction by the Dean of Cornell University's College of Engineering that the U.S. will be faced with a serious shortage of engineering manpower by the mid-1970's; cites figures on manpower needs and number of graduates re[illegible]ted in the Manpower Report to the President and by the Bureau of Labor [illegible]tistics which appear to bear out this prediction; claims that the same hold[illegible]e for chemists, although the shortage in their case will emerge in the mid to late [illegible]970's.

2798. Falk, C. E., "R&D Manpower for the Future: 1. A Comparison of Various Projec-

tions", *Research Management*, v. 15, no. 5, September 1972, pp. 13-23.

Presents a broad overview of the R&D manpower situation, comparing various assessments that have been made in recent years for both the immediate and long-range future; identifies the principal variables that will affect employment opportunities for scientists and engineers over the next 2-3 year period, but predicts no significant improvement in the supply/demand picture in the immediate future; describes the outlook for the long-term future, based on projections that indicate a serious shortage of scientists and engineers by 1980; suggests that universities encourage science students to engage in a variety of science activities, and provide broader, more diverse and responsive training programs.

2799. Vetter, B. M., "R&D Manpower for the Future: 2. The Outlook for Scientists", *Research Management*, v. 15, no. 5, September 1972, pp. 24-31.

Surveys the present employment situation for scientists, particularly in the R&D sector; compares various Ph.D. supply projections, noting that the magnitude of the variance among them raises doubts as to the validity of statistical assumptions currently in use; predicts a shortage of scientists by the end of this decade, citing in support the forces tending to decrease the supply as well as those that will give rise to an increased demand; offers quotes from a Conference Board report *(The U.S. Economy in 1990)* which underscores the importance of R&D to the U.S. economy, and describes the consequences of continued reduction of Federal funds for maintenance of an adequate supply of trained scientists and for expansion of scientific research.

2800. Alden, J. D., "R&D Manpower for the Future: 3. The Outlook for Engineers", *Research Management*, v. 15, no. 5, September 1972, pp. 32-38.

Examines the current employment situation for scientists and engineers, and the probable causes; notes the lack of reliable statistics, and the misinterpretation and exaggeration that result; describes the effects of decreased Federal R&D spending and industry's inability to take up the slack; warns of the future consequences of decreasing enrollments in science and engineering courses: reduction in the nation's R&D capacity, in production capability, and ultimately in the national economy, offers suggestions as to actions by industry needed to correct the situation and assure an adequate future supply of the technical people it will need for R&D.

2801. "Combating Technical Obsolescence", *R&D Management Digest*, v. 2, no. 1, July 1972, pp. 11-12.

Describes the efforts of the Eastman Kodak Co. to help its technical people keep abreast of new developments in their various professions; programs offered include: ~60 seminars a year, interplant conferences and symposia, staff attendance at outside symposia and conferences, granting academic assignments and encouragement to attend and conduct seminars at local institutions, ACS Package Courses and others, and encouragement to publish; additionally, Kodak's Department of Informational Services assists by providing a research service and other library services, and through a Current Awareness Program.

2802. Miller, S., and Malin, M., "Jobs in the Environmental Field", *Environmental Science & Technology*, v. 6, no. 8, August 1972, pp. 694-699.

Describes the supply, the demand, and the agencies for environmental manpower; indicates that, even though hard facts are not yet available, more positions will be available in the environmental field; details the activities of various associations and Government agencies, presents a projected estimate of manpower needs in the short-term future, lists agencies that deal specifically with environmental manpower, and details a national contract to identify actual jobs in the environmental area.

2803. Fanning, O., "Be an Ecologist and Put It All Together", *Congressional Record*, v. 118, no. 115, 24 July 1972, pp. E7001-7002.

Predicts that if present trends continue, by 1980 there will be a need in the U.S. for 1/2 million new scientists, engineers, social scientists, lawyers, technicians, and aides in such disciplines as geology, meteorology, oceanography, forestry, and environmental engineering; suggests that "environmental management may be the top growth industry by the end of this decade"; describes the functions of ecologists and the job prospects, educational requirements, and salaries in environ-

mental fields.

2804. *Ocean Science Graduate Students: Data from 1969 Survey*, National Academy of Sciences, National Research Council, June 1972, 19 pp.

Tabulates the data obtained through a questionnaire survey of graduate students from the 10 major oceanographic educational institutions conducted by the Panel on Ocean Science Manpower Data of the Committee on Oceanography (now the Ocean Affairs Board); tabulations include chief influence that led to choice of marine science, year of undergraduate degree, number of graduate schools applied to, reason for selection of a particular institution, graduate major (area of marine science), employment preference, and foreign students (number and country of origin).

2805. Moses, L. E., "The Response of Graduate Enrollment to Placement Opportunities", *Science*, v. 177, no. 4048, 11 August 1972, pp. 494-497.

Provides statistics on trends in university enrollments and degrees awarded in the physics field, as well as on transition of bachelor's students in Ph.D. graduate programs; projects from these statistics the 1975 and 1980 physics Ph.D. "crop"; presents two conclusions, which would also apply to graduate study in other fields: there is a substantial excess of supply over demand for Ph.D.'s, and a major consequence in adjusting to this excess will be a reduction of entrants into Ph.D. programs; offers suggestions as to desirable institutional adjustments to reduced graduate enrollment, e.g., establish no new Ph.D. programs in an existing field, curtail inferior programs, and effectively prune admissions.

2806. Middlebrooks, E. J., and Snider, R. G., "Professional Manpower Production", *Journal of the Water Pollution Control Federation*, v. 44, no. 7, July 1972, pp. 1307-1316.

Presents the results of a survey of the principal U.S. educational institutions producing water-quality management personnel which was conducted to detect trends and production capabilities; presents data on training grants, faculties, distribution of enrollment and graduates, initial employment of 1970-71 graduates, financial support, and future enrollment trends.

2807. *Engineers' Overseas Handbook*, U.S. Department of Commerce, Bureau of Domestic Commerce, 1971, 250 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.50.)

Presents the results of a questionnaire survey covering 114 countries of the free world; the questionnaire comprised 12 questions which represent the basic prerequisite for practice of engineers overseas under average conditions; the handbook is designed to assist U.S. engineering firms in developing business overseas by providing a condensed source of information on market conditions in the countries covered by the survey.

2808. "Discrimination Against Women in Physics", *Physics Today*, v. 25, no. 7, July 1972, pp. 61-62.

Discusses the conclusions and recommendations included in a report by the American Physical Society Committee on Women in Physics appearing in the June issue of the APS *Bulletin*; data compiled by the Committee revealed the extent of discrimination experienced by women physicists; a major recommendation called for establishment of a Committee on the Status of Women.

2809. "NAS Plans Scientists' Freedom Appeal", *Chemical & Engineering News*, v. 30, no. 37, 11 September 1972, p. 4.

Describes recent actions taken against scientists in the U.S.S.R., notably the dismissal from the University of Moscow, demotion from head of Institute of Electrochemistry, and harassment of Dr. V. G. Levich, member of the Soviet Academy of Sciences (Ref. 2966); discusses the National Academy of Sciences' plans to defend scientists' right to practice their profession by organizing an appeal reaffirming the freedom of scientists to conduct their research without political or professional reprisal.

METROLOGY

2810. "Kushner to Head U.S. Delegation to IOLM Meeting", *U.S. Department of Commerce News*, G 72-177, 26 September 1972, 1 p.

Announces the nomination of Dr. L. M. Kushner, Acting Director of the National Bureau of Standards, as head of the first U.S. delegation to the International Organization for Legal Metrology, which was founded to promote international cooperation on the legal aspects of measurement; U.S. membership in the 36-nation body was urged by President Nixon as a means "to assure a positive role [for the U.S.] in the international standards for measurement and . . . to expand our international trade".

2811. "Convention Establishing an International Organization of Legal Metrology", *Congressional Record*, v. 118, no. 127, 9 August 1972, pp. S13189-13192.

Presents the text of the Convention which is designed to serve as a center for documentation and information, to foster closer relations with weights and measures services in each of the member states of the organization, to furnish advisory assistance to interested countries, to determine the general principles of legal metrology, to recommend uniform international requirements for measuring instruments, and to work out model laws and regulations for consideration by member countries.

MEXICO

2812. "Mexico's Science and Technology", *International Science Notes*, no. 28, September 1972, pp. 4-5.

Briefly describes the U.S.-Mexico Agreement for Scientific and Technical Cooperation, which envisions, in particular, the exchange of scientists and technicians, the execution of joint research, personnel training programs, joint meetings, and other activities to stimulate progress in science and technology; notes the increasing efforts being devoted to science and technology in Mexico, and presents highlights of the activities of Mexico's recently established Council of Science and Technology (CONACYT), whose program will serve as the basis for policy decisions and government action to decrease dependence on foreign technology; the Council's activities have been focused chiefly on education (promotion of student fellowships and student exchanges), on emerging priorities (such as arid-zone development, environmental pollution, national resource reserves, and marine science), and on technology transfer.

NATIONAL SECURITY

2813. Klass, P. J., "DOD Tightens Control on R&D", *Aviation Week & Space Technology*, v. 97, no. 11, 11 September 1972, pp. 14-15.

Discusses Pentagon plans to introduce a new management technique for the approximately $1.5 billion spent annually for research and exploratory development so as to direct the effort more effectively toward potential military needs; plans call for the publishing of a series of management planning documents called *Technology Coordinating Papers* which will require extensive interchanges between scientists from different military services who are working on similar technologies; outlines the basic categories of research to be covered in the TCPs, which include aeronautical propulsion and vehicles, electron devices, environmental sciences, human resources, medical and biological sciences, surface vehicles, and weapons technology.

2814. "A Forum on Nuclear Disarmament", *Impact of Science on Society*, v. 22, no. 3, July-September 1972.

This issue of *Impact* is devoted entirely to a series of articles dealing with various aspects of nuclear disarmament, such as: the technical, strategic, and political questions involved in achieving a comprehensive nuclear test ban; the lack of progress in halting the nuclear arms race and the underlying reasons; the SALT talks as the key to more universal arms control, and the difficult issues that complicate these talks; proliferation of nuclear arms to more countries as a means of forcing present nuclear-arms powers to negotiate more seriously; the U.S.-U.S.S.R. arms race and means of ending it; and international control of disarmament.

2815. Shapley, D., "Herbicides: DOD Study of Viet Use Damns with Faint Praise", *Science*,

v. 177, no. 4051, 1 September 1972, pp. 776-779.

Analyzes the conclusions and recommendations of a 3-volume study, *Herbicides and Military Operations*, performed by the Army Corps of Engineers' Strategic Studies Group for the Department of Defense; the report is the first major review of the military effectiveness of herbicides, and was intended to complement the ongoing National Academy of Sciences study of the ecological and physiological effects of herbicides; the primary conclusion was that herbicides were of only limited usefulness in the Vietnam war; results of the survey concerning the need for herbicides in future conflicts indicate that DOD's staunch support for herbicides is weakening.

2816. Schlesinger, J. R., "National Security in 'An Era of Negotiations' ", *AEC News Releases*, v. 3, no. 39, 27 September 1972, pp. 10-13.

Cites statistics which reveal the drastic reductions that have been made in U.S. expenditures for defense, and argues against any further reductions; emphasizes that to cut defense procurement and R&D from the present level would seriously endanger the strength and resiliency of the U.S. defense-industrial base, and would entail undue dependence on early recourse to tactical nuclear weapons; points out that the U.S. technological edge is the factor that permitted the U.S. to reach the SALT agreements, and that it is important to maintain and expand our technological base so as to provide bargaining power in future negotiations.

2817. "Convention on Biological and Toxin Weapons Transmitted to the Senate", *U.S. Department of State Bulletin*, v. 67, no. 1732, 4 September 1972, pp. 253-257.

Reprints President Nixon's message on the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction, and a statement by Secretary Rogers which summarizes the Preamble and 15 Articles of the Convention; while the Convention constitutes an effective ban on biological warfare, one Article is designed to encourage international cooperation on the peaceful uses of biological agents and toxins.

OCEAN – RESOURCES

2818. Humphrey, H. H., "Oceanography: The Quest for Secrets of the Sea", *Congressional Record*, v. 118, no. 121, August 1972, pp. S12436-12438.

Presents 3 articles by Mr. A. Rossiter, Jr., focusing upon the national unawareness of the values of the oceans; Rossiter examines the new science of oceanography, the threat of pollution to the oceans, and the challenges posed by the U.S.S.R. to the U.S. lead in ocean technology.

2819. *Eighth Annual Conference of the Marine Technology Society Preprints*, 1972, 782 pp. (Available from Marine Technology Society, 1730 M St., N.W., Washington, D.C. 20036. Price: $15.00.)

Presents a compilation of papers delivered at the MTS Conference; included were papers which assessed the prospects for continental shelf access of scientists, engineers, and technicians; examined the potential of the shelf as a source of metal and mineral reserves (viz., gold and the platinum group, the spinel minerals, and titanium, nickel, zirconium, and hafnium); considered the possible impacts of marine mining activities (e.g., disturbance of fishery ecology and habitats, coastal erosion, degradation of beaches, hazards to navigation, cables, and pipeline); and analyzed the economic potential (reaching the conclusion that "marine placer mining is not presently economically justified").

OCEAN – U.S. ACTIVITIES

2820. *Law of the Sea and Peaceful Uses of the Seabeds*, Hearings before the Subcommittee on International Organizations and Movements of the Committee on Foreign Affairs, House of Representatives, 10 and 11 April 1972. (Available from U.S. House of Representatives, Committee on Foreign Affairs, Washington, D.C. 20515.)

Presents testimony and materials submitted at the 2-day hearings focused primarily on the U.N.-sponsored Law of the Sea Conference planned for 1973 and prepara-

tions for it; the hearings were held with the aim of promoting better congressional and public understanding — and gaining a balanced definition — of the U.S. interests in the law of the seas and seabeds.

2821. *A Report to the President and the Congress by the National Advisory Committee on Oceans and Atmosphere*, First Annual Report, June 30, 1972. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 40 cents.)

Offers recommendations for the wise management of the limited resources of air and sea; *Law of the Sea:* (1) U.S. should maintain free passage outside the 12-mile limit, (2) ocean fisheries should be managed by the adjacent coastal nation, (3) U.S. should maintain its policy of freedom of research on the open sea; *Fisheries:* (1) pertinent Government agencies should be strengthened and used more effectively in international ocean programs, (2) international participation in on-going ocean research should be increased, (3) exchange of research programs and techniques between the U.S. Navy and foreign navies should be extended; (4) U.S. production of fish products should be increased; *Weather Modification:* (1) the potential risks should be recognized, (2) social, legal, and economic issues raised thereby should be addressed and immediate action taken (legislation, regulation, research, international agreement); *Coastal Zone Management:* (1) coastal zone legislation should be enacted promptly, (2) research and technical advisory sources should be established at each management level (local, State, and Federal).

2822. *Federal Plan for Marine Environmental Prediction, FY 1973*, National Oceanic and Atmospheric Administration, 1972. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 75 cents.)

Outlines the principal goals of the Federal effort in marine environmental prediction (MAREP); plans call for the outlay of $211 million (subject to Congressional approval) to provide services and support research programs in the fields of MAREP; the marine environment, in these studies, is considered to include not only the open oceans and seas, but also the Great Lakes and "all air, sea, and land interactions in coastal regions involving marine-related variables".

2823. *The Federal Ocean Program: New Emphasis Seen*, 1972, 121 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents.)

Surveys recent activities and examines the outlook for the future; presents highlights of the "ocean" budget for FY 1973: total request, $672 million, an increase of $50 million over 1972; defense request, ~$97 million, a decrease of ~$30 million from 1970; according to the Nixon Administration, the decline in the defense area is outweighed by increases for transportation, coastal-zone development, "nonliving resources", oceanographic research, and fishery development; and the new ocean program represents an increased commitment and a new emphasis on "life and environment" as key factors in operations and planning.

2824. "Monitoring of Ocean Resources and Pollution", *Inside R&D*, v. 1, no. 16, 19 July 1972, p. 2.

Announces a joint program by NASA, TRW Systems, and NOAA to study subtle color changes in the sea surface as the key to long-range monitoring of ocean resources and pollution; plans call for a survey of areas off the U.S. east and west coasts by high-flying jet transport equipped with specialized instruments and by surface craft, and subsequent comparison of the data obtained by each; this technique, if successful, could speed development of ocean resources.

2825. "Deep Sea Experimental Buoy Enroute to Gulf of Alaska for Testing in Sub-Arctic Waters", *U.S. Department of Commerce News*, Release NOAA 72-99, 1 August 1972, 3 pp.

Describes tentative plans to develop a national system of buoys that will furnish vital oceanographic and meteorological information from sparsely covered water areas, and present activities designed to explore the feasibility of such a system; points out that "a network of automatic buoys would provide the data required for predicting weather, sea conditions, fish migration, and other conditions with an impact on man and his endeavors".

2826. "Floating U.S. Marine Research School Sails October 9 from Miami on 10-Week Voyage to Seven Latin-American Ports", *U.S. Department of Commerce News*, Release NOAA 72-121, 2 October 1972, 4 pp.

Announces a study program, sponsored by the National Oceanic and Atmospheric Administration, to be conducted on board a U.S. research vessel; young scientists, university faculty members, and students from 5 Latin American countries will utilize the ship's facilities to carry out marine research projects which have high priority in those countries; outlines program plans as well as the sailing schedule, ports of call, etc., for the research vessel.

2827. Pickle, J. J., "Who Cares About the Ocean", *Congressional Record*, v. 118, no. 130, 14 August 1972, pp. E7464-7466.

Urges support of greatly expanded efforts to learn about the nature of the oceans, and describes a research project being conducted by the Marine Science Institute of the University of Texas having a twofold objective: to encourage educational activities in the coastal environment, and to perform both basic and applied research that will allow sensible use and management of that environment; reprints an article by F. A. Moritz describing additional ocean research now in progress.

PHILIPPINES

2828. Salcedo, J., Jr., "Scientists and Progress in the Philippines", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 175-185.

Describes the sound structure of science and strong government support for science programs in the Philippines, stemming from the recognition of science's role in furthering economic progress; discusses the constraints imposed on scientists by bureaucratic procedures and the conflict between tradition and modern science and technology, and notes actions directed toward mitigation of these constraints: the exemption of national science and technological agencies from bureaucratic restrictions in specific cases, and resolution of the tradition/science conflict through education.

POLLUTION – AIR

2829. McElheny, V. K., "Quarrel Over Car Pollution", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 8-9.

Discusses the major trends in control of car pollution in addition to the 1975-1976 standards: mandatory inspection of antipollution devices on new and used cars, and retrofitting of pollution controls onto uncontrolled or partially controlled cars; describes the tough pollution laws in California, and the differences in emphasis between Federal regulations and California law; the EPA calls for steep reductions in pollutants on new cars, accompanied by drastic limitations on downtown traffic and garage construction, parking, etc., while California stresses the control of oxides of nitrogen, and terms EPA standards impractical.

2830. Cohn, V., "Standing Firm on Auto Emissions", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 6-7.

Describes testimony by automobile manufacturers' representatives presented to EPA Administrator W. D. Ruckelshaus and his aides during 3 weeks of hearings; car makers argued for a 1-year delay in the deadline for meeting emission standards, claiming that it was not technologically feasible to do so by 1975; Ruckelshaus, however, ruled that the companies had failed to prove that "present control technology is not available"; testimony revealed divergent views on effectiveness of present catalysts, and pointed up the success achieved by Toyo Kogyo with the Wankel engine.

2831. *Air Pollution Technical Publications of the U.S. Environmental Protection Agency*, May 1972, 52 pp. (Available from Air Pollution Technical Information Center, Research Triangle Park, North Carolina 27711.)

Lists all the technical publications issued by the EPA's Office of Air Programs; the AP series of publications report the results of scientific and engineering studies, and information of general interest in the air pollution field; while the APTD series report technical data of limited interest to a readership; includes an index.

POLLUTION – NOISE

2832. *Noise Facts Digest*, U.S. Environmental Protection Agency, 1972, 202 pp. (Available from Chief of Technical Publication, Office of Noise Abatement and Control, U.S. Environmental Protection Agency, Washington, D.C. 20460.)

This pilot issue of the Digest contains two articles, one assessing the preliminary impact of Chicago's Noise Ordinance adopted in 1971, and the other giving details of the EPA's new noise information retrieval system; provides about 200 abstracts of material selected from the most recent and significant of the domestic and foreign literature; material abstracted was selected on the basis of its potential interest to a wide range of readers, including not only specialists in noise abatement and control, but also such persons as state and local officials, planners, builders, and highway engineers; includes subject and author indexes, a glossary, and lists of abbreviations, acronyms, and sources.

2833. "EPA Announces Community Noise Study", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 4 August 1972, 2 pp.

Announces the initiation of a federal interagency program (funded by EPA and DOT) to measure noise and its effects on people; contracts have been let for the development of an experimental plan (1) to devise a method for measuring noise from all sources which accurately relates to the way people respond to the total noise environment, (2) to determine the contribution of noise from various sources to the total noise environment, and (3) to aid government agencies in such efforts as establishment of priorities for noise reduction programs, and for environmental impact prediction and evaluation, federal technical assistance to state and local governments, and improvement of measurement technology.

2834. Tunney, J. V., "Urgent Need to Control Airport Noise", *Congressional Record*, v. 118, no. 136, 5 September 1972, pp. S14066-14069.

Presents 2 articles concerning damage from and new attacks on airport noise; one article cites evidence from a University of California report that the physical and emotional health of children attending schools near Los Angeles International Airport is being threatened by jet aircraft noise; the other describes efforts being made to control noise, and outlines the difficulties faced, for example, in enforcing antinoise laws.

POLLUTION – PESTICIDES

2835. Bosch, R. van den, "The Cost of Poisons", *Environment*, v. 14, no. 7, September 1972, pp. 18-22, 27-31.

Examines the shortcomings of current pest-control methods, reviews the consequences of disregard for insect ecology and genetics, and discusses proven alternatives to insecticides which rely on "biological, cultural, genetic, and behavioral principles to control pests in ways that assure good crop yields at minimum expense to the grower and to the environment"; contends that the "key to reduced use of insecticides in agriculture in general lies in comprehensive utilization of ecologically sound alternatives to chemical pesticides".

POLLUTION – PROBLEMS AND CONTROL

2836. Ruckelshaus, W. D., "The Environment – New Challenge for Industrial Research", *Research Management*, v. 15, no. 5, September 1972, pp. 39-43.

Describes the challenge to American industry and industrial management posed by new constraints stemming from environmental concerns; outlines ways in which good environmental practices by industry can increase markets and profitability; describes the role of the Environmental Protection Agency and of industrial R&D in achieving pollution control, which demands application of the best available technology now, careful monitoring of results, and constant efforts to improve pollution-control methods.

2837. *The Steel Industry and Environmental Quality*, Report of Subcouncil, National Industrial Pollution Control Council, August 1972, 26 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 30 cents.)

Summarizes typical accomplishments by the steel industry in their environmental control programs and the status of numerous programs in progress; outlines the trends of future programs, stressing the cost of pollution control to the steel industry under present air- and water-quality control legislation ($3.5 billion for capital investment and $400 million in annual operating costs); offers recommendations concerning the levels of standards to be set, establishment of long-term, low interest loans for construction of pollution-abatement systems, the award of construction and demonstration grants, and the setting of regulations for some definite period into the future so companies know what to design to.

2838. Freeman, A. M., III, and Haveman, R. H., "Residuals Charges for Pollution Control: A Policy Evaluation", *Science*, v. 177, no. 4046, 28 July 1972, pp. 322-329.

Discusses the rationale for the residuals charge approach to environmental management, describing its economic logic and explaining how it would work in practice; clarifies misconceptions and answers criticisms concerning residuals charges (e.g., they are "licenses to pollute" and would hinder industrial abatement); points to the failure of the current policies of environmental regulation, and concludes that a new environmental strategy is needed which minimizes reliance on regulation-enforcement and emphasizes the use of economic incentives as a means of pollution control.

2839. Stone, R., "The Evaluation of Pollution: Balancing Gains and Losses", *Minerva*, v. 10, no. 3, July 1972, pp. 412-25.

Illustrates how information about techniques of production and the preferences of the community can be combined to provide a basis for an antipollution policy; recognizes the problems of collecting data or deciding what to surrender in order to enjoy the amenities pollution destroys, but suggests that economists can contribute to their solution if they forego their preoccupation with market values; discusses the consequences of alternative methods of charging for elimination of pollution and examines the problem of the limit to which elimination should be taken.

2840. "The Myths of Pollution", *Boardroom Reports*, v. 1, no. 5, 30 June 1972, pp. 1-3.

Examines 6 misunderstandings regarding pollution; presents the actual facts concerning such areas as recycling, nonphosphate detergents, and energy generation, and relates the economic realities of environmental cleanup and its effect on U.S. companies' ability to compete internationally; highlighted are such facts as: (1) the cost of recycled paper is often higher than that of ordinary paper; (2) there is a need for greatly expanded research on conventional power sources; and (3) companies in all developed countries are faced with pollution-control costs, and competition from the developing nations not concerned with pollution control is so small as to pose no real threat; concludes that the net result of the "myths of pollution" has been the misdirection of energy, dollars, and time.

2841. Freeman, A. M., III, and Haveman, R. H., "Clean Rhetoric and Dirty Water", *The Public Interest*, no. 28, Summer 1972, pp. 51-65.

Points out that despite the enactment of numerous laws designed to improve environmental quality, air and water pollution in the U.S. continues to increase; contends that this is due to the fact that existing legislation is based on a regulatory strategy; stresses the need for an economic-incentives approach to pollution control, and explains the workings of the political system militating against this type of approach (such as tendencies to shift the responsibility for unpopular decisions to lower levels of government and to postpone those decisions likely to generate adverse political repercussions); suggests that the greatest barrier to pollution control in the U.S. is the "politics of power", rather than technology, population, or public attitudes.

2842. *Environmental Quality: Third Annual Report of the Council on Environmental Quality*, August 1972, 450 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $2.00.)

Contains President Nixon's transmittal message wherein he summarizes the progress made in controlling pollution, stressing the contribution of NEPA; initial chapters of the report describe the development of environmental indices, the importance and difficulties of forecasting environmental trends, and the international aspects of environmental quality; succeeding chapters review progress in the past year

toward controlling pollution, describing the expanding federal role, state activities, and efforts of local governments to control noise; later chapters describe the impacts of NEPA (which represents a reform in government decision making), the costs and economic impacts of environmental improvement, and national parks' difficulties in meeting demands for recreation as well as their environmental pollution problems; the final chapter views environmental quality from a number of important perspectives.

2843. Holden, C., "CEQ Report: Good News, Bad News, A Bit of Indignation", *Science*, v. 177, no. 4049, 18 August 1972, p. 593.

Presents some highlights of the third annual report of the Council on Environmental Quality, including the Council's announcement of an overall improvement in the nation's air quality between 1969 and 1970, and the Council's revised estimate of the amount of money needed for environmental clean-up efforts – $287 billion for the entire decade, or 2.2% of GNP; presents the gist of the 3 chapters which the Council withheld from the report: *energy* – points up the environmental pros and cons of various energy sources; *solid waste recycling* – concedes that this mode of waste disposal is the least attractive alternative from an economic standpoint; *Delaware River Basin* – a case study of the staggering pollution problems that beset that area.

2844. Ruckelshaus, W. D., "The Future of the Automobile", *Environmental News*, 13 September 1972, 12 pp.

Discusses the limitations of exhaust emission controls and outlines other measures for improving air quality being considered by various citi. (metered traffic, exclusive bus lanes, staggered working hours, sanctions against single occupancy driving, etc.); describes the interrelationships among the automobile and all aspects of society, and stresses the need for a "broad systems approach integrating emissions control of motor vehicles with highway planning, land and energy use, resource conservation, demographic factors, economic growth, and the protection of wilderness and countryside".

POLLUTION – WATER

2845. *Water Pollution Abatement Program: Assessment of Federal and State Enforcement Efforts*, Environmental Protection Agency, Report to the Congress by the Comptroller General of the United States, 1972, 55 pp. (For availability contact the Comptroller General of the United States, Washington, D.C. 20548.)

Assesses enforcement efforts in five states; outlines practices in certain states which led to more effective enforcement: (1) establishment of interim dates for submission of plans and start of construction of waste-treatment facilities, which provided a basis for measuring progress; (2) a close working relationship between the State pollution-control agency and the State attorney general's office; (3) establishment of an effective system for monitoring the progress of polluters in abating pollution. stresses the need for better coordination among federal and State agencies; concludes that the pollution situation has improved with the switchover from reliance on voluntary compliance to strict enforcement.

2846. Cleary, E. J., "Evolution of Social Attitudes and Action on Water Pollution Control", *Journal Water Pollution Control Federation*, v. 44, no. 7, July 1972, pp. 1301-1306.

Offers a perspective on 4 distinct periods of change in public attitudes, and how they have shaped responses to the pollution problems; considers the question of the benefit to society of pursuing a clean water goal defined in terms of 'zero discharge' now dominating discussion as to national policy; traces the evolution of national policy toward water degradation, which, over the past 70 years, has undergone a complete reversal.

2847. Messinger, W. C., "Industrial Water Pollution Control", *Vital Speeches of the Day*, v. 38, no. 20, 1 August 1972, pp. 632-635.

Presents data on costs and expenditures for water pollution control by industry to emphasize what industry has already done on its own initiative to alleviate the pollution problem; $4 to $5 billion was spent on pollution control by industry in 1971, and the estimates for 1972 and 1975, respectively, are $6 billion and $10 billion annually.

2848. "EPA Signs Agreements with Polish Agencies for Pollution Research Projects", *Environmental News*, Environmental Protection Agency, Washington, D.C. 20460, 23 July 1972, 2 pp.

Announces the initiation of 8 water-pollution related studies to be carried out by Polish scientists, with the Water Economy Research Institute in Warsaw being the coordinating Agency; the projects will focus on such areas as the utilization and disposal of sludge, the control of eutrophication, the protection of groundwater against the infiltration of surface pollution, and the effects of heated water from power plants; the results are expected to have wide application to the water-pollution problems of the U.S. and other industrialized nations.

2849. Sebastian, F. P., Jr., "Environmental Technology in Developing and Developed Countries", *Congressional Record*, v. 118, no. 122, 2 August 1972, pp. E7275-7276.

Describes some advanced waste treatment developments, specifically in South Africa and China, to demonstrate the benefits of available water pollution technology to *developing* and *developed* nations: (1) wildlife preservation, (2) money savings, (3) economic growth increase, and (4) avoidance by developing countries of the errors of developed nations and the subsequent need for significant investment in corrective programs.

2850. "EPA Publishes Bibliographies on Subsurface Water Pollution", *Environmental News*, 27 September 1972, 1 p.

Announces publication of a 3-part bibliography entitled "Subsurface Water Pollution, A Selective Annotated Bibliography", which lists published research (1968-1971) in water resources based on computerized data of the Interior Department's Water Resources Scientific Information Center; Part I covers literature on subsurface waste injection; Part II, on saline water intrusion; and Part III, on percolation from surface sources; copies available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Va., 22151, at $3 per printed copy and 95 cents per microfilm.

POPULATION

2851. Holden, C., "Population Committee Launched", *Science*, v. 177, no. 4055, 29 September 1972, p. 1178.

Describes efforts of the Commission on Population Growth and the American Future to educate the public on the findings and recommendations of its report and to put pressure on government agencies to move ahead in particular areas; efforts include a movie to be aired over the Public Broadcasting System on 29 November, speeches to many professional and volunteer organizations, and visits to government agencies to explain relevant areas of the Commission's research.

2852. Theisen, S. P., "Perspectives in the 'Population Crisis' ", *Vital Speeches of the Day*, v. 28, no. 22, 1 September 1972, pp. 697-703.

Attempts to place the problems connected with the population crisis in proper perspective, criticizing authors such as P. Ehrlich for their "scare tactics" concerning the consequences of overpopulation; concludes that the growth rate of the U.S. population is very manageable, that there is no justification for tactics to speed the reduction of the birth rate in the U.S., and that "propaganda tactics of the Zero Population Growth movements are doing serious damage to the quality of American public discourse".

PRIORITIES FOR R&D

2853. *Physics in Perspective*, Physics Survey Committee, National Research Council, National Academy of Sciences, 1972, v. I, 1065 pp. (Available from Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C., 20418. Price: $25.00.)

Examines the status of the entire field of physics, at a time when the high growth rate enjoyed by U.S. science, and by physics in particular, has leveled off or declined; describes the overall power and vitality of U.S. physics, and documents impressive advances in all its subfields especially at the interfaces between physics

and other disciplines; stresses the need for increased Government financial support for physics, and identifies 15 high-leverage program elements (including controlled fusion, higher energy nuclear physics, and biophysical acoustics) having growth potentials that warrant high priority for incremental support; offers specific recommendations on such considerations as styles of research, education, manpower, communications, and institutions and support.

2854. *Research and Development in Industry, 1970: Funds, 1970: Scientists and Engineers, January 1971*, Surveys of Science Resources Series, National Science Foundation, Report NSF 72-309, April 1972, 110 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.00.)

Presents results of a Census survey of industrial R&D for 1970 broken down by performer and sources of funds (industry and Federal Government), by type of industry, geographic location, and type of cost (wages, materials, other); includes data on number of scientists employed (by industry and size of company), on Government supported R&D scientists and engineers, and funds for basic research, applied research, and development performance; contains 17 charts, 59 tables, and 2 appendixes.

RESOURCE MANAGEMENT

2855. "New Study Will Examine Environmental Issues Bearing on Formation of a Materials Policy", *News Report (NAS/NRC/NAE)*, v. 22, no. 6, June-July 1972, p. 1.

Announces the initiation of a NAS/NAE study concerning broad environmental considerations that might enter into national decisions affecting supply, transport, consumption, and recycling of materials; issues to be considered include: (1) limitations on resource supply as a result of environmental policies; (2) anticipation of the environmental effects of selected materials from the point of exploration through disposal and recycle; and (3) international agreements affecting availability of resources.

2856. "Needed: A Better Materials Policy", *OECD Observer*, no. 59, August 1972, pp. 16-18.

Summarizes suggestions for improved materials policies offered by the Materials Research Advisory Group of the OECD Committee for Scientific and Technological Policy; defines the role of a national materials policy, and outlines some features which should be incorporated: continuing review of the whole materials scene; provision for coordinating government sectoral programs and policies relating to materials; stimulation of innovations in materials and the industrial use of new developments; dissemination of information to members of the "materials community"; improved communications between industry, universities, government, etc.; and improved education of materials scientists and engineers.

2857. Brahtz, J.F.P. (Ed.), *Coastal Zone Management: Multiple Use with Conservation*, University of California Engineering and Physical Sciences Extension Series, John Wiley and Sons, Inc., New York, N.Y. 10016, 1972, 352 pp. ($19.50)

Sets forth a rational approach to regional management of the coastal zone; contains 2 parts, each consisting of 5 chapters; Part 1 includes discussions by specialists in five classical areas of goals and conflicts relating to multiple use of coastal zone resources; Part 2 offers discussions of technological requirements and resources responsive to the goals delineated in Part 1; authors of the individual chapters are: J.P.P. Brahtz (Introduction), W. A. Nierenberg, M. B. Schaefer, P. Clawson, E. M. MacCutcheon, F. J. Hortig, D. Sternlight, N. F. Schneidewind, J. G. Hammer, E. A. Pearson, and L. D. Cathers.

2858. *Compilation of Federal Laws Relating to Conservation and Development of Our Nation's Fish and Wildlife Resources, Environmental Quality, and Oceanography*, prepared for the Committee on Commerce, U.S. Senate, April 1972, 618 pp. (Available from Committee on Commerce, U.S. Senate, Washington, D.C. 20510.)

Consists of two sections, one containing the laws dealing with wildlife conservation, fisheries, and oceanography; and the other dealing with selected aspects of environmental quality; the compilation is organized according to major subject areas such as Fish and Wildlife (General), Wildlife Conservation and Development, Oceanographic Legislation, Laws Implementing International Agreements, General

Water Resource Legislation Related to Fish and Wildlife, and Environmental Quality (including laws concerning air and water pollution, noise abatement, solid waste management, and radiation hazards).

2859. *First Annual Report of the Secretary of the Interior Under The Mining and Minerals Policy Act of 1970 (P.L. 91-631): Part II, Appendices*, U.S. Department of the Interior, March 1972, 142 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $3.25.)

Presents profiles of 90 minerals industries in the U.S., summarizing such factors as demand outlook and issues, major events in 1971, properties and uses of the mineral involved, domestic industry structure and employment, as well as reserves, production, and consumption; discusses the role of minerals in the U.S. economy; reviews the situation with regard to energy sources (natural gas, petroleum, oil shale, coal); summarizes research on and the development in reclamation and recycling; also summarizes mineral research programs of major agencies of the Department of the Interior.

SCIENCE POLICY BIBLIOGRAPHIES

2860. Bausum, H. T., *Science for Society: A Bibliography*, Third Edition, prepared for the Commission on Science Education, American Association for the Advancement of Science, 1972, 101 pp. (Available from Education Department, AAAS, 1515 Massachusetts Ave., Washington, D.C. 20005. Price: $1.00.)

Lists approximately 4000 references, some briefly annotated, to literature dealing with all aspects of the interrelationships of man, society, environment, science, and technology; entries are classified and indexed by content in 6 major categories [reference (atlases, handbooks, bibliographies, etc.); science, technology, society; resources and the environment; education; health; conflicts; and population]; and are further classified in subcategories; as a new feature, in this edition "key" references, i.e., those suggested as a starting point for reading and for obtaining further references on the topic, are marked with an asterisk; includes a subject index.

2861. *Current Literature on Science of Science*, Research Survey and Planning Division, CSIR, v. 1, no. 3, March 1972, 24 pp. (Available from the Research Survey and Planning Division, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 72 annotated references to science policy literature published during 1971-72 in 31 journals, listed under 34 headings, including bioethics, engineer's role, expenditure on R&D, management of R&D, pollution, power plants, and science cooperation.

2862. *Current Literature on Science of Science*, Research Survey and Planning Division, CSIR, v. 1, no. 4, April 1972, 19 pp. (Available from the Research Survey and Planning Division, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 58 annotated references to science policy literature published during 1971-72 in 20 journals, listed under 28 headings, including development assistance, environmental improvement, forecasting, innovation, manpower, and nuclear testing.

2863. *Current Literature on Science of Science*, Research Survey and Planning Division, CSIR, v. 1, no. 5, May 1972, 21 pp. (Available from Research Survey and Planning Division, CSIR, Rafi Marg, New Delhi-1, India.)

Contains 58 annotated references to science policy literature published during 1971 and 1972 in 18 journals, listed under 23 headings, including environmental improvement, innovation, management of R&D, R&D funding, science policy, and technology transfer.

2864. *Catalog of Science and Technology Periodicals Available on 35mm Microfilm*, University Microfilms, 1972, 53 pp. (Available from University Microfilms, 300 North Zeeb Rd., Ann Arbor, Mich. 48106.)

Provides a comprehensive listing of current and backfile science and technology periodicals included in University Microfilms' collection; includes information on advantages of microfilm, price, and ordering.

SCIENCE POLICY STUDIES

2865. *Report of the 1st Meeting of the International Commission for Science Policy Studies of the History of Science Division, International Union for the History and Philosophy of Science, Ulm, West Germany, 9-15 July 1972,* 21 pp. (Available from Dr. I. S. Spiegel-Rösing, Phychologisches Institut, Ruhr-Universität, 463 Bochum, Postfach 2148, West Germany.)

Reports on the actions recommended by the Commission and the initial steps to be taken in implementing these actions: e.g., preparation of a general textbook for the use of students and research workers in science policy studies, and decision makers in science policy; preparation of critical reviews, bibliographies, and national and international anthologies of policy documents; and transmission of the results of research on developing countries to scholars and science policy officials in those countries; outlines tasks intended to develop the science policy studies field, and offers suggestions concerning the future of the Commission; includes appendixes outlining the resolutions adopted, discussing certain ones in detail, and listing possible research projects being considered.

2866. *Science Policy Research and Teaching Units: Europe and North America, 1967-1970,* Science Policy Studies and Documents, Unesco, no. 28, 1971, 378 pp. (Available from Unipub, Inc., P.O. Box 433, New York, N.Y. 10016. Price: $5.00.)

Presents the findings of a questionnaire survey conducted between November 1970 and April 1971, arranged in two parts; Part I consists of a directory of units classified by country, and within each country, by sector: state, higher education, private sector, individuals; Part II comprises 7 specific lists, which include: units by fields of interest and type of activity, scientific personnel of the units, provision for visiting research workers, courses, and research projects.

2867. *Cornell University Program on Science, Technology, and Society — Publications,* Spring 1972, 9 pp. (Available from Program on Science, Technology, and Society 632 Clark Hall, Cornell University, Ithaca, New York 14850.)

Lists examples of the topics of concern to the STS program: ecological impacts of developing technology; technology assessment; science technology, and national defense; public policies for the support and development of science and technology; impact of technology on values and processes of socialization; legal and moral implications of modern biology and medicine; and the sociology of science and technology; briefly describes STS's encouragement of educational innovation, research activities, and related programs; lists publications (reprints, occasional papers, legislative testimony, case studies, and books) that have resulted directly from STS activities and the work of individuals associated with the Program.

2868. Vickers, Sir G., "Commonly Ignored Elements in Policymaking", *Policy Sciences,* v. 3, no. 2, July 1972, pp. 265-266.

Notes the factors which have resulted in the concentration of most of the money and brains on the periphery of the policymaking problem, while the core elements have been largely ignored; briefly describes the essence of the 5 elements: (1) endurance through time, (2) management of conflict, (3) value adjustment, (4) modelling historical process, and (5) modelling the "artificial"; suggests that the practical challenge to those concerned with scientific study and the practice of policymaking "is to improve the process without distorting or over-simplifying it".

SCIENTIFIC INSTITUTIONS

2869. Dickson, P., *Think Tanks,* Atheneum, New York, N.Y., 1971, 369 pp. ($10.00)

Briefly reviews the growth of R&D since World War II, into a multibillion-dollar industry; describes the primary functions and characteristics of think tanks (both for-profit and not-for-profit) which differentiate these institutions from other R&D establishments; discusses the past military research activities of Rand Corporation, which served as a model for many think tanks, and Rand's present ventures into nonmilitary areas (health and environment research); examines the redirection of research efforts by many military think tanks toward civil concerns, the emergence of new think tanks created specifically to deal with the problems of analysis, policy research and training for the cities; and the trend toward futurism and goals

research.

SOCIETY – SCIENCE INTERACTION

2870. Walker, E. A., *Do We Really Want to Shut Down the World?*, Remarks before the 48th Meeting of the Annual Congress of Kansas Business, Wichita, Kansas, 6 June 1972, 9 pp. (Available from Aluminum Company of America, Financial and Corporate Communication Section, Public Relations Department, 1501 Alcoa Building, Pittsburgh, Pa. 15216.)

Considers the opinions of some environmentalists that technology alone is responsible for the present situation, and that it must be severely regulated if society is to revitalize the ecology; asserts that the real answer lies not in "turning off technology", but in "pinpointing the problems and then applying or developing the proper technology to solve them"; stresses the need for imagination, innovation, growth, and technological development, and expresses confidence that "science and technology, developed and applied with care ... are capable of heading off the catastrophe that supposedly threatens".

2871. Moore, W. E. (Ed.), *Technology and Social Change*, A New York Times Book, Quadrangle Books, Inc., Chicago, Ill. 60611, 1972. 236 pp. ($2.45)

Presents a collection of articles which examine the consequences of technological change, describe the past and probable future course of technological change, and discuss the setting of social policy; includes a suggested reading list and an index.

2872. Page, J. C., "Engineering Social Systems", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 43-47.

Describes two engineering principles – inverse feedback and blow down – and illustrates their applicability in social systems, such as in public schools systems and the national transportation system (inverse feedback) and in organizations to prevent stagnation (blow down); suggests other areas in which the use of these principles might prove beneficial (in the health care system, and in decision making with regard to Government programs and positions).

2873. Seaborg, G. T., "Science, Culture, Universities, and Government", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 111-122.

Discusses the relationship of science, the humanities and arts, and education, their influence on each other and society, and what bearing government interest and support have upon all of them; emphasizes the need for a more meaningful interplay among these forces to meet a major challenge of our times – that of "maintaining a maximum of freedom and opportunity for growth for the individual in a world of overwhelming technological forces and growing social interdependence and responsibility".

2874. Hippel, F. von, and Primack, J., "Public Interest Science", *Science*, v. 177, no. 4055, 29 September 1972, 1166-1171.

Discusses the abuses by the Government's Executive Branch of its near monopoly of politically relevant and technical information and expertise obtained from science advisors; cites case studies exemplifying the types of abuses that occur: politicalization of advisory committees, and suppression or misrepresentation of information and analyses; case studies cited concern the use of noise suppressors on the SST, a report on sonic boom effects, a report on a weed and brush killer which causes birth defects; and the continued sale of cyclamates as nonprescription drugs for special purposes; examines the influence of public interest activities of in ...dent scientists, and the sources of support for public interest science.

2875. Rabinowitch, E., "Needed: A Political Program for the Technological Age", *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 11-15.

Cites the threats – nuclear annihilation, overpopulation, exhaustion of natural resources, and vast accumulation of wastes – caused by the rapid advancement of science and technology; describes the "habitat of scarcity" previously prevailing, and the present "habitat of plenty" brought about by the scientific and technological revolution; discusses the technological advances which have reduced dependence on scarce natural resources and limited raw materials; urges all societies to use newly acquired technologies for constructive purposes, and stresses

the role of the scientific community in helping mankind to adapt to the technological age.

2876. Alfvén, H., "Science, Technocracy, and the Politico-Economic Power", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 85-93.

Discusses society's adverse attitudes toward scientists or "technocrats" and the consequences of this antitechnocrat trend – reduced scientific investment in the U.S. and the technology gap in Europe; describes the power wielded by the managerial class, which controls the exploitation of new scientific and technical ideas, and by the politicians; points up the public's lack of representation and the nonexistence of a group to counterbalance this power; stresses the danger to society of denying experts the right to speak on major issues, and the necessity for scientists to accept more responsibility for the social effects of their work.

2877. Kranzberg, M., and Davenport, W. H. (Eds.), *Technology and Culture: An Anthology*, Schocken Books Inc., 200 Madison Ave., New York, N.Y. 10016, 25 September 1972, 432 pp. ($10.00)

Contains 22 papers directed toward providing an interdisciplinary approach to the understanding of culture as it has been shaped by technology; the papers are grouped under 4 main headings (Technology and Society, Technology and the Humanities, Man and Machines, and Invention and Innovation), and deal with such subjects as the nature of invention, its relation to static and dynamic societies, the economic and cultural grounds for the growth of ingenuity into technology, and the uses to which technology has been put and could be put, for the better or the worse of mankind.

2878. *Science in the Public Interest*, Proceedings of CSPI Conference, January 29, 1972, 164 pp. (Available from Center for Science in the Public Interest, 1346 Connecticut Ave., N.W., Washington, D.C. 20036. Price: $9.00.)

Presents the text of two papers "The Dearth of Public Interest Scientists" (by R. Ottinger) and "The Scientist as Citizen" (by J. Hobson) delivered at the CSPI conference, the goal of which was "to impress upon scientists and engineers the fact that society needs their skills and participation"; the conference agenda also included panel discussions on "The Need for Science in the Public Interest", "Organizing Scientists in the Public Interest, and "Ethical Responsibility of Scientists and Scientific Societies".

2879. Sieghart, P., "A Corporate Conscience for the Scientific Community?", *Nature*, v. 239, no. 5366, 1 September 1972, pp. 15-18.

Presents a condensation of a paper by an interdisciplinary working party which attempted to bring the social responsibility of scientists into sharper focus, and to devise, within the existing social framework, a practical means for scientists to discharge their special social obligations; discusses means proposed, dismissing them as impractical, dangerous, or beyond the working party's competence; suggests an institutional arrangement – an organized body of scientists whose task is to stimulate informed public discussion about the possible consequences of socially important pieces of scientific research, and urges support of that body by the entire scientific community.

2880. Cordell, A. J., "Technological Progress: Are We the Captives of a Monumental Myth", *Science Forum*, v. 5, no. 4, August 1972, pp. 3-7.

Describes the current preoccupation with increasing economic growth and productivity, which are taken as indicators of social progress; discusses the role of science and technology in promoting growth, and some of the problems that increased productivity creates: solid-waste disposal problems, urban congestion, and depletion of natural resources; suggests extension of technology assessment to include consideration of social costs, and raises a question as to whether "more is necessarily better"; deplores the tendency to prescribe more technology to solve today's problems, and underscores the need to examine the changes taking place in the underlying assumptions on which present-day society is based.

2881. Kistiakowsky, G. B., "American Science at the Crossroads", *Bulletin of the Atomic Scientists*, v. 28, no. 7, September 1972, pp. 4-7.

Describes the challenges to American science posed by the cutbacks in Government support of science and by the prevailing adverse attitudes of society toward

the scientific community; discusses the changing role of science in society, and suggests ways in which scientists may participate more effectively in resolving the critical problems existing today; stresses the need fo the scientific community todirect its efforts toward "development of new technologies that will advance the well-being of... society" and toward "management of these technologies so as to minimize ecological damage...".

2882. Ben-David, J., "The Profession of Science and Its Powers", *Minerva*, v. 10, no. 3, July 1972, pp. 362-383.

Reviews the evolution of scientific research into a full-time occupation, requiring formal training and the acquisition of degrees, and examines the opposition to it; discusses the successes and failures of self-regulation by the scientific community, as well as the limits to the community's role in determining the allocation of research funds; concludes that the scientific community can only participate in the use of scientific research for the solution of practical problems, and that exclusive control by scientists over the allocation of funds and execution of projects is not conducive to making research an increasingly useful tool for man.

2883. Kranzberg, M., "Engineers: America's Revolutionaries", *Vital Speeches of the Day*, v. 38, no. 22, 1 September 1972, pp. 676-683.

Surveys briefly the historical development of technology and its effects on society; discusses public attitudes toward technology, and the efforts of engineers to reform their profession; contends that the question facing engineers is "not whether to join industry, government, or a university, but what they can do about their social awareness and ethical responsibilities within those institutions"; suggests that engineers "enlarge their systems and redefine the concept of efficiency", to take into account such elements as pollution, resource depletion, and other environmental factors, as well as social costs and benefits.

2884. "A New Approach to a False Alternative: Fundamental vs. Applied Research", *OECD Observer*, no. 59, August 1972, pp. 34-37.

Examines the changing scene of research activities, the blurring of the demarcation line between fundamental and applied research, and the ever closer link between science and technology; considers fundamental research as part of the research system, not as an independent element in the range of research activities; describes the levelling off in resource allocations for research stemming from questions as to the possible contributions of science and technology to economic and social development; concludes that new links between science and society will require reorganization of the "research system", and, as a prerequisite, a finer knowledge of the system's components.

2885. "Williston and Main Award Winners and Runners-Up", *Mechanical Engineering*, v. 94, no. 9, September 1972, pp. 30-33.

Presents abstracts of the treatises submitted by the winners and runners-up in the competition for the Williston Medal and Award; these treatises dealt with such issues as the societal responsibilities of the engineer, the role of the engineer in promoting technology transfer to developing countries, and the responsibility of the engineer in avoiding the ravages of a rampant technology by supporting a rational technological policy; the common theme of all the treatises underscored the responsibility of the engineer to make technology the servant rather than the master of mankind, to protect the environment, and to apply the scientific and technical knowledge available for the benefit of mankind.

2886. Fisher, P., "Science Policy and the Trade Unions", *New Scientist*, v. 55, no. 803, 6 July 1972, pp. 16-17.

Examines the history of the interplay between the trade unions and science, technology, and the social sciences; discusses present trade union activities, which include attempts to make government science policy more publicly accountable and more responsive to public needs.

SPACE – EARTH RESOURCES SATELLITES

2887. Strickland, Z., "Experiments Have Global Scope", *Aviation Week & Space Technology*, v. 97, no. 5, 31 July 1972, pp. 46-49.

Describes the large international involvement with, and potential benefits from, the first flight of an Earth Resources Technology Satellite, which is capable of providing repetitive information on 80% of the globe; discusses 7 scientific disciplines of interest during the first mission: meteorology, marine resources, water resources, agriculture in forestry resources, environment, land use, and mineral and land resources.

2888. "Earth Resources Data Available from NOAA; Agency Scientists Using ERTS Data in Varied Studies", *U.S. Department of Commerce News*, Washington, D.C. 20230, NOAA 72-108, 23 August 1972, 4 pp.

Reports that the Commerce Department's National Oceanic and Atmospheric Administration is operating a major center for disseminating data from the National Aeronautics and Space Administration's Earth Resources Technology Satellite, an experimental spacecraft intended to demonstrate the usefulness of repeated global sensing of conditions on the earth's surface; describes the research being carried out through ERTS-1, in areas such as sea-ice distribution; circulation and surface characteristics of oceans, lakes, and bays; air and water pollution; marine resources; and severe storm detail.

2889. "ERTS Launch Raises Data Problems", *Washington Science Trends*, v. 28, no. 16, 24 July 1972, pp. 91-95.

Discusses possible controversies, confusion, and interagency red tape related to the procedures for releasing data obtained from the experimental Earth Resources Satellite; describes concerns that an individual, a company, or a foreign nation could employ these data to reap immense profits from oil discoveries, mineral exploration leads, fishing, or other national resource information; points out that NASA's stated policy of affording wide and impartial access to interim and final findings, and thus accelerating the flow of program benefits to the public at large, may not be followed by the many other agencies at large; describes arrangements for establishing "browse" rooms, and provides a comprehensive listing of the browse facilities of various agencies.

SPACE – INTERNATIONAL COOPERATION

2890. Hudock, R. P., "Space Cooperation: A Growing Political Force", *Astronautics & Aeronautics*, v. 10, no. 9, September 1972, pp. 6-9.

Reviews the vast number of international space agreements entered into by the U.S. since 1957, and outlines 6 major U.S. Government policies which interact to direct U.S. international space moves; these include: encouragement of space cooperation so as to share the benefits and burdens of this adventure, the establishment of a single global satellite telecommunications system, the conviction that the American people are entitled to a fair return on their heavy investment in space technology in the form of improved services in such areas as weather forecasting, communications, and flight safety; and encouragement of the foreign market for American products, including technology, so as to improve the U.S. balance of trade.

2891. "America Will Wait", *Nature*, v. 238, no. 5360, 21 July 1972, p. 12?

Announces the U.S.'s decision to extend until autumn the deadline for Europe's decision as to the part it wants to play in the post-Apollo program, as a result of the cancellation of a European Space Conference which was to decide Europe's attitude toward the shuttle; discusses concern over NASA plans to limit Europe's participation to development of the research applications module, whereas Europe had expected to have the responsibility for developing the space tug.

2892. Strickland, Z., "Fletcher Expects Year-Long Soviet Flight", *Aviation Week & Space Technology*, v. 97, no. 1, 3 July 1972, p. 21.

Discusses an intuitive opinion held by Dr. J. C. Fletcher, administrator of the National Aeronautics and Space Administration, that the Soviets are working toward a year-long manned space flight, a mission quite possibly prerequisite to future manned planetary flights; other topics discussed by Fletcher concerned Skylab missions, the space shuttle, and joint U.S.-Soviet space plans.

SPACE – PROGRAMS AND GOALS

2893. *United States Space Science Program*, Report to COSPAR, Fifteenth Meeting, Madrid, Spain, May 1972, submitted by Space Science Board, 1972, 71 pp. (Available within limits of supply from Space Science Board, National Academy of Sciences/National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

Outlines facilities for space research in the U.S. and describes international cooperative activities (data exchange and cooperative projects at NASA); summarizes stellar observations from spacecraft, rockets, and satellites, solar observations, lunar and planetary research, and other studies in the earth and life sciences fields; briefly reviews technological developments within the Apollo program.

2894. *Aeronautics and Space Report of the President – 1971 Activities*, Executive Office of the President, National Aeronautics and Space Council, 125 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.25.)

Reviews the U.S. space program in 1971 in terms of achieving 6 specific objectives: (1) continued moon exploration, (2) exploration of the planets and the universe, (3) substantial reduction in space operations cost, (4) extension of man's capability to live and work in space, (5) expansion of practical applications of space technology, and (6) greater international cooperation; describes the activities of NASC, the many government agencies, as well as NAS/NAE/NRC and the Smithsonian Institution in support of the space program; notable accomplishments, in addition to the Apollo missions, include: communications, earth-resources-monitoring, and environment-monitoring satellites as well as progress on Skylab, the space shuttle, and toward international cooperation.

2895. Ehricke, K. A., "Man Can Use Interstellar Space", *Congressional Record*, v. 118, no. 114, 21 July 1972, pp. E6968-6969.

Outlines the earth's unique place in the solar system and the importance of continued manned space flight; contends that "technological progress can expand industry beyond earth", and describes, as an example, a procedure for disposal of nuclear wastes in interstellar space.

2896. Gwynne, P., "Sad Days for NASA", *New Scientist*, v. 55, no. 803, 6 July 1972, p. 39.

Describes the dim prospects for the future facing the National Aeronautics and Space Administration due to Federal cutbacks in financial support; describes the schedule for manned space flights throughout the 1970's, which reveals a gap of about 5 years between the last Skylab flight and the first flight of the space shuttle in 1978, with the sole exception of the U.S.-Soviet joint mission.

2897. Bulban, E. J., "Soyuz Orbit Now Set Before Apollo", *Aviation Week & Space Technology*, v. 97, no. 4, 24 July 1972, pp. 12-14.

Announces a change in plans for the joint U.S.-U.S.S.R. mission set for mid-1975, which now calls for the Soyuz spacecraft to be launched ahead of Apollo; describes launch backup procedures, as well as docking and atmospheric control systems for the joint mission.

2898. "NASA Orbits Largest Space Telescope", *Chemical & Engineering News*, v. 50, no. 35, 28 August 1972, p. 4.

Describes the progress of the Orbiting Astronomical Observatory Copernicus, launched August 21, 1972, which will begin full-time astronomical observations on August 29, 1972; the primary objectives are to study the interstellar absorption of hydrogen, oxygen, carbon, silicon, and other common interstellar elements, and to investigate ultraviolet radiation from young hot stars; of more immediate interest to the earthbound, is the study of the effect of the atmosphere on extraterrestrial radiation.

SPACE – SHUTTLE

2899. Hudock, R. P., "Space Shuttle: The Clean Machine", *Astronautics & Aeronautics*, v. 10, no. 6, June 1972, pp. 6-7.

Discusses the National Aeronautics and Space Administration's draft environmental impact statement for the space shuttle program, which indicates only minor environmental risks but considerable benefits through the application of earth-

sensing technologies to monitor and control environmental quality worldwide; discusses the 3 possibly adverse environmental effects — air pollution, sonic boom, and reentry of the orbiter tank — all of which have been carefully considered, and provisions made for their control.

2900. Mueller, G. E., "Space Shuttle, Beginning a New Era in Space Cooperation", *Astronautics & Aeronautics*, v. 10, no. 9, September 1972, pp. 20-25.

Describes the coming space shuttle era, pointing out that it will "present not only opportunities but also necessities for international cooperation on an increasingly broad basis"; discusses the 3 phases expected to evolve: successive cooperative developments, wide-ranging passenger services, and then mature operations — large-scale space works and expeditions; points to developments (nuclear energy, supersonic transports, etc.) in other countries using technologies developed in the U.S., and suggests that shuttle technology transfer will spur development in the same manner; outlines the requirements for success in international cooperative programs.

2901. Strickland, Z., "Cost Controls Stressed on Shuttle", *Aviation Week & Space Technology*, v. 97, no. 11, 11 September 1972, pp. 100-103.

Discusses the revisions which will have to be made in the National Aeronautics and Space Administration's development of the space shuttle owing to the tight budgetary constraints facing the Agency; reports that systems testing will have to be greatly curtailed, and describes the approach to be taken to cope with the problem: thermal and vibration testing will be emphasized, since their worth was established during the Apollo program, and high quality will be demanded of vendors of components.

SPAIN

2902. Walsh, J., "Spain (I): A Developing Economy Puts Spanish on the Threshold", *Science*, v. 177, no. 4043, 7 July 1972, pp. 36-39.

Discusses the effects of Spain's social and political history and isolation on its economy and its scientific and educational communities; describes recommendations by the OECD (Organisation for Economic Co-operation and Development) which urge that Spain adopt a science and technology policy directly related to the problems of the balance of trade; notes the Spanish Government's efforts to adopt new priorities, which include heavier investment in R&D and extensive educational reform.

2903. Walsh, J., "Spain (II): An Understanding with the Americans", *Science*, v. 177, no. 4044, 14 July 1972, pp. 153-155.

Discusses the need for Spain to place higher priority on domestic R&D to narrow the technological gap between Spain and industrially more advanced countries of the European Common Market; describes the U.S. assistance to be provided under a U.S.-Spain agreement on cooperation (including scientific and technical cooperation); the National Science Foundation is the program manager for the cooperative projects (ranging from education to applied research), for which some $3 million in U.S. funds has been earmarked.

2904. Walsh, J., "Spain (III): Education Reform Drawn on Outside Ideas, Support", *Science*, v. 177, no. 4045, 21 July 1972, pp. 241-244.

Describes the ambitious program of education reform being undertaken by the Spanish Government, under which reforms are being instituted at every level of education; discusses the resistance to the reforms, and the crisis in the schools created by the effort to initiate a large building program, recast the curriculum, and reform teacher training simultaneously; the principle underlying the reform is that access to higher education be governed by the student's ability, not economic status, and the major aim is to achieve the "unity and interrelation" of the various levels of education.

STATE AND LOCAL SCIENCE ACTIVITIES

2905. Lepkowski, W., "Technology Policy for the People", *Science Forum*, v. 5, no. 4,

August 1972, pp. 19-20.

Describes a new science and technology policy, civilian in purpose, now emerging in the U.S., which has as its objective the transfer of knowledge and technological hardware to the cities, towns, counties, and states; presents an excerpt from the President's message on science and technology wherein he proclaims that "State and local governments should have a central role in the application [of technology] process"; cites two reports concerned with the need for public tecanology - "Public Technology: A Tool for Solving National Problems" [*SPR* 5(2):2511], and "Power to the States: Mobilizing Public Technology" [*SPR* 5(2):2510].

2906. "Technology and the New Federalism", *Nature*, v. 237, no. 5357, 30 June 1972, pp. 479-480.

Discusses 2 drawbacks to the Nixon Administration's plans for employing science and technology to deal with domestic problems: (1) state and local governments' lack the expertise and machinery for handling decisions involving science and technology, and (2) federal policy on science seems to be formulated with scarcely any input from those ultimately responsible for carrying it out; discusses the problems of bringing technological innovation into the public sector, and of bringing state universities, industry, and government into partnership to help technology transfer and innovation; chief among the recommendations being formulated is that state and local governments be in on the planning of federal programs and policies.

2907. "Urban Technology Procurement", *Washington Science Trends*, v. 28, no. 17, 31 July 1972, p. 99.

Announces the award of a grant from the U.S. Economic Development Administration for the development of techniques which cities, counties, and states can use in procuring nonstandard, technology-oriented items; the aim of the effort is to aid in the specification and purchasing of advanced computer systems, new waste disposal plants, and other "hard" and "soft" by-products of technology.

2908. *The Last and First Frontier: Science in the Service of People*, Film prepared by Pennsylvania State University Materials Research Laboratory interpreting the operation of a Governor's Science Advisory Committee, 16 mm, 22 min. (Available on loan from The Audio Visual Library, Pennsylvania State University, University Park, Pa. 16802. Price: $6.60 for postage and handling; no rental fee.)

Describes the rationale for and operation of Pennsylvania's Science Advisory Apparatus and depicts science policy making at the State level; reports how this was developed and now functions, its organizational linkages to the State Legislative and Executive branches and to the Federal Government, and records some of its accomplishments.

SWEDEN

2909. "Organization of Research in Sweden", *R&D Management Digest*, v. 2, no. 2, August 1972, pp. 10-12.

Examines the institutional arrangements for the planning and support of research in Sweden; among these are: the Government Research Advisory Board which provides a link between Government and research, and serves as a forum for joint deliberation on long-term science policy; the RIFO, composed of many of the members of the national legislative body (the Riksdag) as well as scientists, which promotes contact and understanding between members of the Riksdag and the research community, and which organizes task forces to study subjects that may have future importance for legislators, with particular reference to their scientific and technological implications; additionally, research is supported by various academies (e.g., the Royal Academy of Sciences), research councils and other agencies (who are responsible for allocation of Government funds for R&D), the Board for Technical Development, and a variety of research institutes.

SWITZERLAND

2910. "The Division of Science and Research", *Embassy of Switzerland Bulletin*, v. 12, no. 2, July 1972, pp. 34-39.

Describes the general organization of the Division, which was created by the Swiss Government in March 1969; discusses the Division's central role in establishing science policy, and describes its overall tasks as well as specific tasks in the fields of research and education.

TAIWAN

2911. *A Report on the Sino-American Colloquium on Ocean Resources*, held at Taipei, Republic of China, 28 April – 6 May 1971, Academy Sinica, 1972, 44 pp. (Available from Board on Science and Technology for International Development, Office of the Foreign Secretary, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.)

Assesses Taiwan's marine resource base, identifying problems likely to develop in exploiting major resources, and proposing actions directed toward their solution; considers governmental machinery required to assure coordination of national planning and decision making with the results of research on marine resources, recommending institutional changes to facilitate this linkage; discusses R&D programs involving decisions on research priorities, as well as estimated manpower, educational, and facilities requirements; highlights benefits of international cooperation in ocean research, and identifies those programs in which participation is desirable.

TECHNOLOGICAL INNOVATION

2912. *The Conditions for Success in Technological Innovations*, Organisation for Economic Co-operation and Development, 1971, 169 pp. (Available from OECD Publications Center, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $4.00.)

Identifies the factors influencing the technological innovation process, and discusses its implications for national policy; discusses the three elements essential to successful technological innovation: scientific and technical capability, market demand, and an agent to transform this capability into goods and services which satisfy the demand; describes the role of industry, the universities, and government in promoting technological innovation; presents annexes assessing the national performance in technological innovation in 10 countries (including the U.S.), and identifies areas where further study is needed; includes references and bibliographies.

2913. Groeger, T., "Novelty and the Degeneration of Progress", *Chemtech*, July 1972, pp. 390-392.

Critizes the present conviction of many in industry that everything new or young is better than the known and old; ascribes this attitude chiefly to the nature of patentability, which per se requires novelty; argues that novel in this complex world means more complex, and that to replace things tailored to basic needs by more complex things for the sake of novelty degenerates progress; describes the problems created by the emphasis on novelty and urges that industry reexamine the problem and consider less complicated, less costly innovations.

2914. "Incentive Program for Technological Innovation?", *Inside R&D*, v. 1, no. 23, 6 September 1972, p 2.

Notes optimism over the prospects for immediate initiation by the U.S. Government of a vast incentive program to aid the nation's technological innovation, expressed by a Department of Commerce science/technology expert; reports, however, that foot-dragging by Congress, with the Senate and the House unable to agree on the dollar figure for the program, may delay the program until at least next summer (see Refs. 2915 and 2916).

2915. "National Science Foundation Needs Industry's Help with Innovation Research", *Inside R&D*, v. 1, no. 17, 27 July 1972, p. 2.

Calls upon industry to provide information on the best ways for NSF to help turn laboratory developments into marketable products (i.e., to help industry innovate); describes a 3-phase program planned by the NSF to: (1) identify barriers to implementing new ideas, (2) determine what Government can do to remove

barriers to innovation, and (3) test various incentives in selected industries; this program will be carried out mainly with the aid of university-based scientists, and while they can make an important contribution, a much more substantial input from industrial R&D people is essential to the success of the program.

2916. "NSF Opening R&D 'Incentives' Program", *Washington Science Trends*, v. 28, no. 26, 2 October 1972, p. 151.

Presents details of the National Science Foundation's Experimental R&D Incentives Program to explore means of spurring technical innovation; according to present plans, the program will support background studies to identify and understand barriers to technological innovation, and experiments designed to investigate incentives (e.g., tax advantages) intended to overcome these barriers; initially, special attention will be given to (1) industries with little or no R&D, (2) small high-technology industries utilizing research results from other sources, (3) fragmented industries whose individual companies cannot support research, and (4) industries with fragmented and variable market requirements; most of the experiments are expected to involve cooperative projects.

2917. Mansfield, E., Schnee, J., Rapoport, J., and Wagner, S., *Research and Innovation in the Modern Corporation*, W. W. Norton & Co., New York, N.Y., 1972, 239 pp. ($10.00)

Provides an inexpensive "cram" course on latest techniques for managing R&D; reports findings and conclusions resulting from detailed studies; principal conclusions are: (1) in most industrial R&D there is a greater risk of commercial failure than of technical failure; (2) major cause of unsuccessful research is the discovery that the project has poor commercial prospects; (3) large cost and time overruns are not unique to military research and probably permeate civilian R&D as well; (4) the use of econometric models to predict the cost of developing a new product or process appears to be more effective than quantitative project-selection techniques; and (5) R&D costs represent only 50% of the total innovative process, with plant construction, plant start-up, and putting the marketing plan into operation comprising the balance.

2918. "Industry Hoping for New Technology", *Inside R&D*, v. 1, no. 10, 7 June 1972, p. 4.

Reports findings of a Conference Board study which indicate that industry is looking to new technology to offset higher wage costs; the study reveals an 11.4% increase in first-quarter capital appropriations (over 1971) for the 1000 largest manufacturers in the U.S., as well as a further increase during the second quarter for several hundred of these firms; according to the Conference Board, this money is to be spent particularly for improved technology.

TECHNOLOGY ASSESSMENT

2919. Jordan, B. E., "Technology Assessment Act of 1972", *Congressional Record*, v. 118, no. 143, 14 September 1972, p. S14941.

Reports to the Senate the Technology Assessment Act of 1972, and briefly summarizes its salient features; the act extends the Congressional information-gathering function with an Office of Technology Assessment (OTA) in the legislative branch, composed of a policy making body called the Technology Assessment Board, and an operation unit headed by a director; the basic responsibilities of the OTA would be to provide an early appraisal of the probable impacts (positive and negative) of applications of technology and to develop other information which might assist the Congress in performing its legislative tasks.

2920. Rothman, H., "Report of the OECD Seminar on Technology Assessment", *R&D Management*, v. 2, no. 3, June 1972, pp. 143-144.

Reviews the emergence of technology assessment (TA) brought about by the growing sensitivity to the harmful side effects of technology; describes the focus of the OECD seminar, much of which was devoted to discussions of methodologies for practical TA: for example, "a closed loop reiterative process involving many steps and groups", isolation of effects, and cross-impact matrix; other discussions concerned the need for independent units to conduct TA, rather than government or industrial agencies, and the question of the effect of TA on industrial security; one suggestion arising from the seminar was that the OECD might promote a series

of TA case studies in member countries to help advance understanding of the art.

2921. Coates, V. T., *Technology and Public Policy: The Process of Technology Assessment in the Federal Government*, Program of Policy Studies in Science & Technology, The George Washington University, July 1972, Summary, 47 pp; v. I, 335 pp; v. II, 261 pp. (Available from National Technical Information Service, Springfield, Va. Price not determined yet.)

Presents the findings of a questionnaire survey conducted to identify the locations at which technology assessment (TA) was performed, and by what procedures, with the overall aim of improving technology assessment by Federal agencies; offers 9 recommendations intended to strengthen TA within the Government as well as its value to the public, which call for such actions as attention to anticipatory assessment from the agencies, immediate performance of TA without awaiting further methodology development, consistent pressure for TA from OMB and Congress, the development of new independent agencies to conduct and sponsor TA activities, and a national survey (sponsored by the NSF) to identify pressing TA studies, as well as those of an anticipatory nature.

2922. "How Well Do Agencies Assess Technology?", *Science News*, v. 102, no. 1, 9 September 1972, pp. 166-167.

Reviews the findings of the study by V. T. Coates (Ref. 2921) on Federal agency technology assessment; Coates (1) describes the priority given to assigning social scientists to multidisciplinary technology assessment teams, which results in a general conservatism in considering the social aspects of proposed programs; (2) discusses assessment deficiencies in the U.S. Department of Agriculture, in the National Institutes of Health and other biomedical agencies; and (3) contends that agencies having conflicting roles as promoters and regulators of technology, such as the AEC and NASA, tend to adopt a promotional stance toward their respective technologies.

TECHNOLOGY TRANSFER

2923. Ozawa, T., *Transfer of Technology from Japan to Developing Countries*, UNITAR Research Reports, no. 7, 1971, 50 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Deals with the overall nature and general trends of Japan's transfer of technology and describes modernization experiences resulting from Japan's technological transformation; analyzes the effects of competition from developing countries on Japan's transfer of technology; describes the means of labor training — the most crucial aspect of the transfer process, as well as the mechanisms used to transfer the technology.

2924. Mason, R. H., *The Transfer of Technology and the Factor Proportions Problem: The Philippines and Mexico*, UNITAR Research Reports, no. 10, 1971, 101 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Examines several interrelated aspects of the problem of transferring technical know-how from advanced to less developed countries, with special emphasis on the factor proportions problem (the question of capital intensity); explores the role of direct investment by multinational firms and its influence on the choice of technology; concludes that multinational firms cannot, with any certainty, be viewed as the major source of the factor proportions problem, and suggests closer examination of the incentive systems provided by the developing countries themselves.

2925. Stobaugh, R. B., *The International Transfer of Technology in the Establishment of the Petrochemical Industry in Developing Countries*, UNITAR Research Reports, no. 12, 1971, 67 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Describes the variety of possible arrangements available for transmitting petroleum technology; discusses the conflicts of interests likely to exist between host nation and firm, and offers proposals as to how these might be resolved; outlines suggested policies for developing countries concerning plant size and number of

plants, plant ownership (foreign or local), and amount of tariff protection to be leveled.

2926. Chudson, W., *The International Transfer of Commercial Technology to Developing Countries*, UNITAR Research Reports, no. 13, 1971, 61 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Presents a general survey of the Transfer of Technology series as a whole and of the main implications which emerge; describes the importance of the access to new technology in developing countries; assesses the international market for technology, the appropriateness of the technology supplied, R&D by suppliers, the training and personnel policies of large firms, and national and international policies for technology transfer; includes the questionnaire through which the information in this report was collected.

2927. Wortzel, L. H., *Technology Transfer in the Pharmaceutical Industry*, UNITAR Research Reports, no. 14, 1971, 53 pp. (Available from Publications Office, UNITAR, 801 United Nations Plaza, New York, N.Y. 10017. Price: $2.00.)

Defines technology as it exists today in the pharmaceutical industry and assesses the extent to which that technology has been transferred to developing countries; offers recommendations on how this technology could be transferred more effectively to such countries; describes future prospects for pharmaceutical research and manufacturing in developing countries.

2928. "Government-Owned Technology Soon to be Available", *Inside R&D*, v. 1, no. 23, 6 September 1972, pp. 2-3.

Announces completion of the final draft of regulations to govern transfer of U.S. Government-held patents to industry, granting exclusive license; NASA has published a list of 1,892 patents, including abstracts, available for license (Directory available for $6.00 from National Technical Information Service, Springfield, Va.), and other agencies are making plans to follow suit; the Patent Office is considering ways to provide a complete list of the 22,000 patents, and some type of service listing these patents by technical category will be offered in 3 or 4 months.

2929. "Unique Ways to Transfer Technology", *Inside R&D*, v. 1, no. 25, 20 September 1970, pp. 3-4.

Describes General Electric Co.'s means of promoting transfer of its technology, that is, through GE's Business Opportunities Service which periodically sends subscribers a list of technology available not only from G.E. but from many other firms that pay for their listing; in addition, G.E. has initiated a New Business Search Program, whereby G.E. technology-transfer specialists will match stated needs and goals of a subscribing company with latest developments available for sale or licensing by G.E. and more than 40 other major firms; each subscribing company will receive periodic summaries of the opportunities identified for that particular firm.

2930. "Barriers to Technology Transfer Studied", *Aviation Week & Space Technology*, v. 97, no. 8, 21 August 1972, pp. 12-14.

Discusses the international trade situations that are forcing the U.S. to reexamine its technology transfer policy, and identifies governmental and institutional barriers to trade (e.g., statuatory, financial, and informational); describes a National Science Foundation experimental R&D incentives program (Ref. 2916) aimed primarily at finding ways to get technology out of the laboratory and into industrial or governmental applications; points out that two-thirds of the program will be aimed at industrial experiments and one-third at public-sector-type projects.

2931. "'Technological Protectionism': No Longer Unthinkable", *Science and Government Report*, v. 2, no. 12, 15 September 1972, pp. 1-2.

Discusses the pros and cons of "technological protectionism" which is emerging as a major issue with the advent of increasing international cooperation in science and technology; the proponents question the wisdom of providing U.S. technology to our competitors in the world market, and are concerned with maintaining U.S. technological superiority; the opponents include: (1) the Administration, which actively promotes technology exchange and sees better performance by U.S. industry as the key to overcoming competition; (2) Presidential Science Advisor

David who suggests that free trade should be encouraged, but with greater recognition of the market value of technological information; and (3) others who contend that, on balance, the U.S. emerges far ahead when technology is transferred abroad.

2932. Benedict, H., "New Era of Exploration — Midcourse Correction for Spaceship Earth", *Congressional Record*, v. 118, no. 119, 28 July 1972, pp. S12160-12162. [Reprinted from *Birmingham* (Ala.) *News*, 16 July 1972.]

Describes the future of the space program and the vast possibilities offered by the application of space techniques to other fields of endeavor; possibilities include: the use of satellites for communications, as education aids, and for monitoring earth resources and pollution; conduct of studies aboard the space lab in such areas as astronomy, life sciences, and new sources of energy; use of part of the lab as an experimental hospital to treat certain ailments under weightlessness and vacuum conditions; and the manufacture, in space, of such items as perfectly round ball bearings and pure vaccines.

2933. "The National Academy of Engineering Appoints A Space Applications Board Organizing Group", *News Report (NAS/NRC/NAE)*, v. 22, no. 6, June-July 1972, p. 2.

Announces plans for establishment of a Space Applications Board which will have the responsibility for identifying and analyzing the potential of space applications to enhance man's efforts in such areas as manufacturing, navigation, communications, transportation, agriculture, meteorology, geology, geography, mining, and health care; the Board will "collect and analyze information on the needs of the nonaerospace community and inform that community of the state-of-the-art and potentials of space techniques and capabilities" and "stimulate active collaboration among the various components of governmental and industrial communities".

2934. *Technology for the Cities*, First Annual Report of the Public Technology/National Aeronautics and Space Administration Technology Application Program, 1971, 42 pp. (Available from National Aeronautics and Space Administration, Technology Utilization Office, Washington, D.C. 20546.)

Summarizes the status (at the end of 1971) of the first 6 of 15 problems identified as having the highest probability of solution under the Technology Applications Program, which has as its objective the application of aerospace technologies to the solution of selected municipal problems; also outlines the progress and plans for all 15 problems; most of the problems lie in the fire protection area, the others being in such areas as law enforcement, traffic control, short-range communications, and waste management; includes 6 appendixes listing the participating cities and 43 top-priority problems and describing the technology application methodology.

2935. "Ocean Technology Coming Ashore?", *Technology Review*, v. 74, no. 8, July/August 1972, pp. 60-61.

Describes improvements made by engineers in oceanographic equipment such as cables and insulated wire; points out that problems still exist concerning quality control and adherence to specifications; claims that "we're still taking land technology to sea", and suggests application of ocean technology ashore, pointing out, as an example, that the ignition system of a car is more sensitive to moisture than are electronic instruments used at the bottom of the sea.

TRANSPORTATION

2936. Thurmond, S., "Speech by Secretary of Transportation John A. Volpe on Our Transportation System", *Congressional Record*, v. 118, no. 118, 27 July 1972, pp. E7117-7119.

Presents the remarks of Mr. Volpe given at the 1972 Transportation Conference of the American Society of Civil Engineers concerning the role of technology in the U.S. transportation system; Secretary Volpe outlines 4 major program thrusts for FY 1973: expansion of R&D activity in transportation, continual establishment and upgrading of safety measures and standards, recognition of the environmental impact of highway construction, and revitalization of urban transportation facilities with financing possibly provided by the Highway Trust Fund.

2937. "Sometimes a Wet Noodle", *Technology Review*, v. 74, no. 8, July/August 1972, p. 57.

Presents a 5-point transportation R&D program wherein automation plays a central role, outlined at a M.I.T. Lincoln Laboratory Seminar by R. H. Cannon, Jr., Assistant Secretary for Systems Development and Technology in the Department of Transportation; the program includes air and harbor traffic control improvements; freight car identification and location systems; highway improvements to provide better information about traffic conditions and to automate traffic control devices more efficiently; and vehicle monitoring.

2938. "Testimony by Secretary of Transportation John A. Volpe", *Congressional Record*, v. 118, no. 141, 12 September 1972, pp. E7840-7842.

Presents the testimony of J. A. Volpe before the Senate Subcommittee on Housing and Urban Affairs concerning the public transportation provisions of the Federal-Aid Highway Act of 1972, which included recommendations as to specific amendments that must be incorporated in the Act if it is to become a balanced transportation bill; amendments recommended will, for example: (1) allow rail transit projects as well as bus purchases to be funded out of the Highway Trust Fund; and (2) set the Federal share for public transportation projects at the same level as provided for all highway projects (other than Interstate), namely 70%; amendment of the Urban Mass Transportation Act to provide a $3 billion authorization for additional contract authority is also recommended.

2939. Biaggi, M., "Conference on Transportation and Human Needs", *Congressional Record*, v. 118, no. 112, 19 July 1972, pp. E6875-6876.

Presents the remarks of Secretary of Transportation J. A. Volpe to the Conference on Transportation and Human Needs, outlining the objectives of the Department of Transportation, and discussing several projects under consideration to deal with urban transportation problems; Secretary Volpe asserts that "public mass transit is not only the best answer but it is the only answer to a number of major urban problems . . ."

2940. *New Transportation Systems and Concepts*, Highway Research Record No. 367, Highway Research Board, 1971, 151 pp. (Available from Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418. Price: $4.00.)

Presents a collection of 12 papers on advanced concepts in urban mobility, primarily intrametropolitan transportation systems; one paper summarizes current conditions and recommends public priorities and necessary transport service parameters; others discuss demand-actuated systems, systems for extended urban areas and major activity centers, methods of evaluating new system concepts, and large-scale implementation of complete new systems.

2941. *The Urban Transportation Planning Process*, Organisation for Economic Co-Operation and Development, 1971, 351 pp. (Available from OECD Publications Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. Price: $6.00.)

The final session of a 3-day meeting (Paris, June 30-July 2, 1969), convened by the OECD Consultative Group on Transportation, explored the present deficiencies and needed directions for improving the process of planning for urban transportation; presented in this book is the report (in English and French) of a 25-member panel which is based principally on the discussion at that session; the report examines such issues as the social elements of transportation policy, the goal-setting process, greater involvement of the public in decision making, and evaluation of transportation system alternatives; also presented are a bibliographical survey on transportation planning and systems analysis, and three papers: "On Strategies for Transportation Planning", "Towards Maximizing Urban Transportation's Potentials", and "New Directions in Strategic Transportation Planning".

2942. Weicker, L. P., Jr., "Mobil Oil Corp. Urges Return to Balance in Transportation Planning", *Congressional Record*, v. 118, no. 143, 14 September 1972, pp. S14951-14952.

Reprints an advertisement by the Mobil Oil Corp. which urges that Congress develop a national program to improve mass transit, and reexamines the desirability of the Highway Trust Fund; contends that the problem is largely one

of imbalance, with highway building dominating Federal transportation policy — 70% of the U.S. transportation budget being spent on highways, and only 5% on mass transit.

2943. *Federally Coordinated Program of Research and Development in Highway Transportation: Introduction and Summary*, U.S. Department of Transportation, Federal Highway Administration, 20 March 1972, 70 pp. (Available from U.S. Department of Transportation, Federal Highway Administration, RD-2, Washington, D.C. 20591.)

Describes the purpose and concept of the Federally Coordinated Program (FCP), and the resources available for highway research and development; the FCP is organized in 9 program categories (with 54 identified projects) covering highway design and operation, traffic congestion and operational efficiency, environmental considerations, highway materials, costs and structural safety, construction and maintenance, R&D implementation, demonstration program, and R&D management; gives information on obtaining additional details concerning individual projects.

2944. Roncalio, T., "The Volpe Plan and Its Effect in Large-Area States — Analysis of the 1972 Highway Needs Report", *Congressional Record*, v. 118, no. 122, 2 August 1972, pp. H7124-7126.

Describes the recommendations included in the 1972 National Highway Needs Report, submitted by Secretary of Transportation Volpe to the U.S. House of Representatives Committee on Public Works, which include a major reclassification of authorization categories within the highway trust fund for fiscal years 1974 through 1979; discusses the detrimental effects this reclassification will have in large-area states, focusing on its effects on the development of urban and highway transportation systems in Wyoming.

2945. Ritz, P. M., "Railroads in the Year 2000", *Projection Highlights* (National Planning Association, 1606 New Hampshire Ave., N.W., Washington, D.C. 20009), v. 2, no. 8, August 1972, 4 pp.

Presents statistics on intercity freight and passenger traffic by type of transport for 1950-1970 and offers some predictions as to the railroad situation by the year 2000: (1) transportation's share of the U.S.'s real output will have declined slightly from 1970 levels, but railroads share will have been virtually halved; (2) freight traffic will account for almost all railroad output; (3) railroad commuter passenger traffic will decline only slightly over the next 30 years, but total rail passenger traffic will continue to decline precipitously; (4) Federal government support of railroads is expected to increase, and the financial situation of railroads as a whole will have improved somewhat; describes technological developments in competing industries and their impact on railroads.

2946. Steele, R. H., "Steel Wheels on Steel Rails", *Congressional Record*, v. 118, no. 111, 18 July 1972, pp. E6857-6859.

Presents a condensation of a treatise on American railroads by C. O. Anderson, which outlines the current problems of the U.S. transportation system and the role of the railroad in the total transportation scheme; describes the imbalance in the development and financial support of the various means of transportation in the U.S., with the emphasis being on the highway system while the rail system has been all but abandoned; stresses the greater efficiency of rail service for intercity travel, compared with the automobile, and suggests that higher speed, coupled with this efficiency, would assure the superiority of rail service for intercity passenger transportation.

2947. Shoup, R. G., "Transportation's Role in Recycling Waste Materials", *Congressional Record*, v. 118, no. 113, 20 July 1972, p. E6930.

Describes the importance of waste recyclamation and discusses a DOT-sponsored study ("Recyclamation — Rail Transport Economics of Substitutability of Recycled Scrap or Waste for Basic Raw Materials") which emphasizes the role of transportation in promoting this operation; contends that a comprehensive program for transportation must be established, and suggests tasks to be assigned to Congress in creating the large transportation system needed: provide adequate funds, establish a materials exemption for highway and water movements, and establish a natural-resources-depletion tax to support the recyclamation program.

UNITED KINGDOM

2948. "Science in Britain: Research Councils Lose Some Autonomy", *Science*, v. 177, no. 4047, 4 August 1972, p. 410.

Discusses the British Government's decision to reorganize British science according to Lord Rothschild's customer-contractor principle; this will involve shifting funds for science from the independent research councils to government departments, which will use the money to commission their own research, and will encourage more mission-oriented research than in the past.

2949. Zuckerman, S., "The Changing Structure of Government Science in the United Kingdom", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 143-156.

Discusses in detail the evolution of the government organization for science in the U.K., and describes the Dainton and Rothschild proposals for restructuring government science, representing another step in that evolution; considers the issue which gave rise to the current debate concerning the proper government science structure – the practical use of scientific knowledge by the government, and the implications of restructuring for the research councils and for scientists; analyzes the significance of civil service reforms proposed by a committee chaired by Lord Fulton; calls for mutual understanding between politicians and scientists in evolving institutional arrangements for science to meet present-day needs and problems.

2950. "Science Research Council Advises the Government", *Nature*, v. 239, no. 5370, 29 September 1972, p. 234.

Presents highlights of the Science Research Council's annual report on its activities and expenditures during 1971-1972; the Council's report also included suggestions regarding the implementation of the customer-contractor principle: for example, the Council calls on the government to ensure that the professions, universities, polytechnics, research councils, executive departments, NRDC and other government agencies "work as an integrated whole to choose national research and development programmes and to ensure the application of the results to the nation's wealth and well-being"; the Council also contends that applied R&D programs will lead to waste and duplication, unless sufficient basic research has been conducted.

2951. "The Rothschild Ship Comes Home", *Nature*, v. 238, no. 5360, 21 July 1972, pp. 124-125.

Describes the implications for the research councils resulting from the British government's acceptance of the chief recommendations of the Rothschild report on the administration of civil science, in particular the recommendation that a substantial part of the money presently spent by the research councils be transferred to the parliamentary votes of what are called customer departments; the council for scientific Policy will be reconstituted, but will still be solely an advisory body; others directly affected are the Agricultural, Medical, and Natural Environment Research Councils.

2952. Williams, R., "Independence and Accountability after Rothschild", *R&D Management*, v. 2, no. 3, June 1972, pp. 131-136.

Presents a preliminary assessment of the core issue of the Rothschild report, "accountability" versus "independence", particularly accountability; points out that while Rothschild's "customer-contractor" principle is likely to present new and serious difficulties for government departments, it may also lead to strengthening of their capabilities; calls for a full discussion of the procedures associated with the principle, and underscores the need for further detailed consideration of the accountability-independence balance.

2953. Shonfield, A., "The Social Sciences in the Great Debate on Science Policy", *Minerva*, v. 10, no. 3, July 1972, pp. 426-438.

Describes the status of the social sciences and the Social Science Research Council (SSRC) of which the author was formerly chairman and considers their position under present U.K. science policy; takes issue with the Rothschild report which dismissed the SSRC on the grounds that it was "not suitable for inclusion within

[the customer-contractor] concept", and discusses the significance of the Rothschild proposals to the SSRC; notes the inclusion in the Dainton report of a work category termed "strategic research" – the type of work espoused by Lord Haldane; outlines the benefits of a close working relationship between government and the social scientists, and examines the ethical problems of social science in relation to government and society.

2954. Budworth, D., "Industry and the Politics of Science", *New Scientist*, v. 55, no. 803, 6 July 1972, pp. 17-19.

Examines the nature of the industry/politics interface in science through consideration of the role of the Confederation of British Industry in the current controversy about government R&D; describes the CBI's organizational structure for dealing with the 2 major elements of its task: (1) to determine its members line of thinking, and to formulate policies in various fields to take account of their thoughts and interests; (2) to scrutinize the Government's and Parliament's actions, to anticipate their future actions, and to attempt to influence their actions in accord with CBI policies.

2955. Langrish, J., Gibbons, M., Evans, W. G., and Jevons, F. R., *Wealth from Knowledge: A Study of Innovation in Industry*, Macmillan, London, England, 1972, 477 pp. (£4.95)

Presents the findings of a case study of all the 84 innovations that gained the Queen's Award for Technological Innovation in 1966 and 1967; analysis of the factors leading to successful innovation revealed the dominance of personal motivation, with clear identification of a need being second in importance; most prominent among the factors causing delay in innovation, was "some other technology not sufficiently developed", with case after case evidencing the need for contemporary technologies; also revealed is "how rare is the occurrence of the logical . . . sequence from science through development to manufacture" and how much more complicated the process actually is.

2956. "R&D Expenditure: A Comparison of Industries", *R&D Management*, v. 2, no. 3, June 1972, pp. 137-139.

Presents an analysis of R&D expenditures by manufacturing and construction industries in the United Kingdom in 1968-69; outlines the major findings of the analysis: the aerospace industry has by far the greatest expenditure on R&D as well as the highest ratio of R&D expenditure to net output (39%); all four of the sectors within the chemical industry (mineral oil refining, plastics, pharmaceuticals and toiletries, and chemicals and coal products) were among the "top 10" industrial sectors for relative R&D expenditure; the leading R&D performing sectors, relative to size, in the engineering industry were electronics, industrial and marine engines, and scientific instruments; the median ratio of R&D expenditure to net output was about 2%, while 10% represents the maximum proportion of net output which any industry devoted to R&D from internal resources alone.

2957. Bailey, R., "Traditional Energy Resources; Present State and Future Development", *Futures*, v. 4, no. 2, June 1972, pp. 103-114.

Discusses the difficulty, particularly in the U.K., of reconciling short-term economic and commercial objectives with long-term technical and supply problems, a difficulty that has been complicated by new elements: the nuclear energy program, the discoveries of natural gas, and the extension of off-shore oil exploration; describes the world energy situation, and the energy problems of industrialized and developing countries; presents projections (to the year 2000) of total energy consumption, consumption of various forms of energy, and population versus per capita consumption.

2958. Kenward, M., "Britain's Nuclear Options", *New Scientist*, v. 55, no. 809, 17 August 1972, pp. 332-335.

Describes the basic operating principles of 5 different types of nuclear reactors (gas, water, and helium cooled, steam generating, and fast breeders), their state of development, the British Government's reactor policy, and the structure of the U.K.'s nuclear industry; discusses the advantages and disadvantages of each reactor type for use in Britain.

2959. "Nuclear Power, Another Eighteen Months of Studies", *Nature*, v. 238, no. 5363, 11 August 1972, p. 303.

Reports that the British government has decided to undertake 18 more months of deliberation and study before making firm decisions on the type of reactor Britain is to build to follow the advanced gas cooled reactors; notes that while the British government reaffirms its faith in the fast breeder reactor, it intends to keep its options open until the fast breeders become available in quantity, sometime in the 1980's; describes the types of reactors now under consideration.

2960. Kenward, M., "Industrial Research at Harwell", *New Scientist*, v. 54, no. 802, June 1972, p. 725.

Describes the controversy surrounding the U.K. Atomic Energy Authority's contract nonnuclear research activities carried on at Harwell which are aimed toward transfer of technology from the nuclear program to other fields; opponents of Harwell's type of research claim that it is irrelevant to the needs of industry; to combat this, the Select Committee recommends establishment of an industrial advisory committee composed of equal numbers of the Authority's staff and industrialists.

2961. Reed, L., "Britain's Role in Europe's Environment", *New Scientist*, v. 54, no. 802, 29 June 1972, pp. 756-757.

Asserts that regional collaboration is both a practicable and desirable way to deal with pollution on an international scope; suggests that the Common Market is the most promising device for enforcing such collaboration in Europe, and identifies 4 goals essential to the successful implementation of a European environmental policy: single welfare and tax provisions to limit population growth, joint management of common estates or shared resources, harmonization of measures to save raw materials and curb pollution, and integration of ecological factors in economic programs and policy decisions.

2962. Smith, A., "Britain Opts Out of Space: A Journalist's Lament", *Science Forum*, v. 5, no. 4, August 1972, pp. 17-19.

Suggests possible reasons for the U.K.'s lack of participation in space activities: the British governments only mild competence and interest in technology and innovation, the British People's preference for a quiet life rather than rapid and unsettling change, and the British Government's convictions that space exploits are beyong the U.K. financial resources and competence; considers participation in space activities invaluable for a country in Britain's position; and maintains that strong national programs and an active part in the space shuttle are the only means to ensure development of a space competence and its maintenance at both the industrial and governmental levels.

2963. "Concorde Production Fund Hike Approved by British Parliament", *Aviation Week & Space Technology*, v. 97, no. 5, 31 July 1972, p. 22.

Discusses the reasons for the $67.5 million British Parliament-approved increase in production funding for the Concorde supersonic transport: inflation and the longer-than-expected period of the development program; describes criticism leveled by the House of Commons Select Committee on Expenditures at both the former Labor and incumbent Conservative governments for their obvious reluctance to be more open with Parliament on Concorde costs and its future prospects.

U.S.S.R.

2964. Gvishiani, D. M., "Centralized Management of Science: Advantages and Problems", *Impact of Science on Society*, v. 22, no. 1/2, January-June 1972, pp. 95-103.

Discusses the need to learn how to manage scientific progress, and to foresee its possibilities, prospects, and social consequences; describes the problems confronting science policy in socialist countries, as well as the financing and planning of science in the U.S.S.R.; outlines 6 arguments supporting the case of centralized management, and examines the problem of obtaining both flexibility and stability in research institutes, and the problems of making full use of scientific personnel, e.g., through retraining and promoting mobility.

2965. Segal, G., "Soviet R&D – The Quest for Efficiency", *New Scientist*, v. 55, no. 803, 6 July 1972, pp. 21-22.

Points out that the U.S.S.R. has lagged behind the U.S. in scientific and industrial development; reviews past efforts of various Soviet leaders to experiment with new models of managing the Soviet economy which would make it more efficient in competition with capitalism; describes attempts to force the pace of science and technology by introducing "payment by results" systems for scientific workers, for example, the efficiency experiment at the Karpov Physicochemical Institute, wherein the wages of professors are based on their real contribution towards the development of science.

2966. "Zhores Medvedev and the Reputation of Russian Science", *Nature*, v. 238, no. 5359, 14 July 1972, pp. 61-62.

Describes the harsh treatment by the Russian Government of Dr. Z. Medvedev, a Russian citizen who has openly expressed his belief that the Russian society should become more liberal and humane; notable is their prevention of his participation in the International Conference on Gerontology; speculates as to the significance of these actions with respect to Russia's international scientific collaboration activities.

2967. Mirsky, E. M., "Science Studies in the USSR (History, Problems, Prospects), *Science Studies*, v. 2, no. 3, July 1972, pp. 281-294 (translated from *Problems and the History of Science and Technology*, no. 3-4, 1971, pp. 87-97).

Traces the evolution of science studies in the U.S.S.R., starting with the early 20th century, when many Russian scientists were concerned with problems of scientific development, science as the servant of the people, and the rapid growth of scientific information, its evaluation, and application; describes the heightened interest in science studies in the postwar period — marked by the recognition of science studies as an independent field, the direction of science studies today (i.e., toward the organization of higher education and scientific research and of research institutions), and the types of existing organizations of scientific activity; notes the increasing efficiency in the application of science studies to problems of organizing and planning research, and stresses the need for the inclusion of science studies courses in university curricula.

2968. "Soviet Education Policy", *Nature*, v. 239, no. 5367, 8 September 1972, p. 62.

Discusses the shortcomings of Russian higher education which places heavy emphasis on the sciences, and which, in turn, implies an expansion of science faculties and institutes; suggests that this expansion is not sufficient to keep pace with the growth of Soviet economy, nor with the increased requirements of science and industry; outlines the actions being taken by the Soviet Government to deal with the problem, with the teaching of "the organization of labour and control", engineering psychology, industrial aesthetics, and computer technology being especially earmarked for improvement.

2969. Goldman, M. I., *The Spoils of Progress: Environmental Pollution in the Soviet Union*, The M.I.T. Press, Cambridge, Mass., and London, England, 1972, 372 pp. ($7.95)

Describes the abuses of water, air, land, and raw materials in the Soviet Union, analyzes the forces responsible for the current situation, and describes the advantages and disadvantages of state control; notes that while the Soviet state's priorities lie with increased production, a number of beneficial state controls exist which could be expanded to include restoration and protection of natural resources; includes appendixes on environment conservation and water laws, a bibliography, and an index.

2970. "Russian Computers", *Nature*, v. 237, no. 5357, 30 June 1972, p. 477.

Describes Soviet plans to develop a Union-wide data processing and control system, which would become virtually a model of the whole economic and productive structure of the Union; the first stage should be complete by 1975, with the introduction of data processing systems in almost all ministries and government departments as well as in several factories.

2971. *Industrialized Building in the Soviet Union*, U.S. Department of Commerce, National Bureau of Standards Special Publication 334, May 1971, 81 pp. (Available from U.S. Government Printing Office, Washington, D.C. 20402. Price: 75 cents.)

Presents the report of the 1969 Exchange delegation to the U.S.S.R. on the status of Soviet building industrialization, with emphasis on housing; describes State

management hierarchy, housing construction procedures, and the trend toward precast concrete as a construction material; compares the costs of U.S. and U.S.S.R. construction systems, and discusses the U.S.S.R.'s urgent need for mass housing which makes industrialized construction imperative.

WASTE MANAGEMENT

2972. Dickson, E. M., "Taking It Apart", *Environment*, v. 14, no. 6, July/August 1972, pp. 36-41.

Examines recycling as a means of solid waste disposal; points out that it is impossible to recycle completely, and very difficult even to recycle to a satisfactory degree; considers the recycling problems associated with automobiles, and suggests a new design ethic for manufacturers ("design for recycling") which takes into account the ease of recycling and avoids unnecessary combinations of materials which complicate or prevent efficient recycling; suggests that the U.S. Government stimulate this ethic by taxing products in proportion to their recycling potential and durability.

2973. "Resource Recovery, A Positive Approach to the Solid Waste Problem", Reprinted from *Nation's Cities*, June 1972, by the National Center for Resource Recovery, Inc., 1211 Connecticut Ave., N.W., Washington, D.C. 20036, 1972, 2 pp.

Discusses "resource recovery" as a means of solid waste management, and notes questions as to its feasibility and time of availability for solving present-day problems; discusses the activities of the National Center for Resource Recovery which has as its primary goal to establish the National Resource Recovery Network to demonstrate the economic and technical feasibility of resource recovery.

2974. Bohn, H. L., and Cauthorn, R. C., "Pollution: The Problem of Misplaced Waste", *American Scientist*, v. 60, no. 5, September-October 1972, pp. 561-565.

Defines pollution as a maldistribution of matter and energy among and within the earth's three great media – air, water, soil – and compares the extent of pollution in these media; contends that "pollution is the direct result of inefficiency – waste – in the use of our material and energy resources and of the misplacement of those resources after use"; charges that the handling of wastes has been unimaginative and expensive, and that man has been wrong to consider wastes useless; points out that the soil has a vastly greater potential for waste disposal and transformation, compared to air and water, and that it can absorb far more material than it can produce or that is added to it.

2975. *Waste Not*, National Center for Resource Recovery, Inc., 1972 8 pp. (Available from National Center for Resource Recovery, Inc., 1211 Connecticut Ave., N.W., Washington, D.C. 20036.)

Discusses the activities of the NCRR, which was designed to coordinate the efforts of industry and labor with those of the Environmental Protection Agency and other public and private institutions in developing long-range solutions to the U.S. solid waste problem; describes NCRR's major thrust – to utilize modern technological systems and management practices to recover valuable and depletable resources from mixed municipal refuse; examines the nature of municipal solid wastes, and describes the types of collection and disposal practices supported by NCRR.

2976. *NCRR Receives Two Study Grants From EPA*, National Center for Resources Recovery, Inc., News Release NR-72-7, 27 July 1972, 2 pp. (Available from National Center for Resource Recovery, Inc., 1211 Constitution Ave., N.W., Washington, D.C. 20036.)

Announces the award of two grants for solid waste research, and delineates their respective objectives: (1) to develop quality-control sampling and testing procedures for materials recovered from municipal waste, and (2) to formulate sales specifications for materials separated from postconsumer mixed municipal refuse, which includes paper, glass, ferrous metal, aluminum and other nonferrous metals.

2977. Solomen, J., "The Social Redemption of Pure Garbage", *The Sciences*, v. 12, no. 6, July-August 1972, pp. 13-15.

Examines the potential of solid waste as a source of power, claiming that if efficiently converted it could furnish as much as 6% of total U.S. energy needs – and with less SO_2 pollution; describes experiments with solid waste conversion processes, as well as some of the problems; contends that the major barrier to the use of solid waste fuel is the general attitude of industry, the public, municipal administrators, et al., who tend to view wastes as "a problem to be minimized, not a natural resource to be exploited"; stresses the need for government and industry participation in the development of effective "waste-to-watts" conversion.

2978. Howard, J., "Technology Attacks the Rubbish Tip", *New Scientist*, v. 55, no. 808, 10 August 1972, pp. 291-293.

Describes the varied composition of both domestic and industrial solid wastes, the particular disposal problems presented by each; and methods for disposing of large amounts of solid wastes; discusses the growing market for equipment to deal with solid wastes and for private, special waste disposal contractors in Western Europe and the United Kingdom.

2979. "Recovery of Metals and Minerals From Scrap", *Inside R&D*, v. 1, no. 26, 27 September 1972, p. 4.

Describes plans for the construction and operation of the Nation's first full-scale resource recovery plant; Raytheon will design the plant and supervise construction, with funds being provided by the Environmental Protection Agency ($2.4 million) and the City of Lowell and the State of Massachusetts ($800,000); usable materials will be separated from the residue from the City's incinerator by density, froth flotation, and magnetic methods, and it is expected that 95% of the residue will be reclaimed in the form of aluminum, zinc, copper, ferrous metals, glass, and sand; a year-long test (by Raytheon) will attempt to show that such an operation can be profitable.

2980. Sullivan, T. A., de Beauchamp, R. L., and Singleton, E. L., "Recovery of Aluminum, Base, and Precious Metals From Electronic Scrap", *U.S. Bureau of Mines Report of Investigations*, no. 7617, 1972, 16 pp.

Report results of U.S. Bureau of Mines research on recovery of metals from electronic aluminum scrap, which may open the way to recycling of many obsolete electronic instruments used by military and space agencies, commercial communications, and industrial electronic operations.

2981. "Plastic Wastes: Irradiate?", *Technology Review*, v. 74, no. 8, July/August 1972, p. 55.

Reports results of a study of the potential of irradiation for disposal of plastic wastes; conclusions were that irradiation is economically unfeasible because of the high radiation dose required, which makes the method impractical for large-scale use; suggests that the technique might find limited application for special problems like highly toxic hospital wastes, and that the economic picture might change if nuclear reactor wastes can be used for the radiation source.

WEST GERMANY

2982. German Science and Technology – Federal Research Report IV", *International Science Notes*, no. 28, September 1972, pp. 10-14.

Confirms the West German Government's announced intent to shift priorities in federally supported research to areas contributing to the Country's economic efficiency and to activities serving to improve overall living conditions, with new research programs in health, environmental protection, communications, and education accenting the trend; Volume I of the report deals with Federal policy and programs, while Volumes II and III deal respectively with university and other educational statistics and background material; listed are the elements of such programs as those for nuclear energy, space, oceanographic research, technological R&D, environment, and aviation research; describes government support of industrial R&D (particularly innovation), and German interest in international cooperation.

Publications Screened For This Issue

AEC News Releases (weekly) U. S. Atomic Energy Commission; Division of Public Information; Washington, D.C. 20545; No charge

American Scientist (bimonthly) 155 Whitney Ave.; New Haven, Conn. 06510; $9.00/yr in U.S.; $9.50/yr elsewhere; $1.75/single issue

Astronautics and Aeronautics (monthly) Received with membership to American Institute of Aeronautics & Astronautics; 1290 Ave. of the Americas; New York, N.Y. 10019; Dues $35.00/yr

Aviation Week & Space Technology (weekly) P.O. Box 503; Hightstown, N.J. 08520; $20/yr for qualified personnel; $30 others; $1.00/single issue

BioScience (semimonthly) American Institute of Biological Sciences; 3900 Wisconsin Ave., N.W.; Washington, D.C. 20016; $24.00/yr

Bulletin of the Atomic Scientists (monthly, except July and August) Circulation Department; 1020-24 E. 58th St.; Chicago, Ill. 60637; $8.50/yr in U.S.; $9.00/yr in Canada and Pan American Union; $9.50/yr elsewhere

The Center Magazine (bimonthly) Fund for the Republic, Inc.; 2056 Eucalyptus Hill Road; Santa Barbara, Calif. 93108; $15.00/yr Associate Membership dues include 6 issues/yr

Chemical & Engineering News (weekly) American Chemical Society; 1155 16th St., N.W.; Washington, D.C. 20036; $8.00/yr

Chemical Technology (monthly) American Chemical Society; 1155 16th St., N.W.; Washington, D.C. 20036; $18.00/yr nonmembers

Congressional Record (daily when Congress convenes) Superintendent of Documents; U.S. Government Printing Office; Washington, D.C. 20402; $45.00/yr; $3.75/mo; 25 cents/copy

Embassy of Switzerland Bulletin (triannually) Office of the Scientific Counselor to the Swiss Embassies in Washington, D.C., and Ottawa, Canada: Contact Mr. G.-A. Grin, Scientific Counselor, Embassy of Switzerland; 2900 Cathedral Ave., N.W.; Washington, D.C. 20008

Environment (monthly except Jan/Feb & Jul/Aug) Committee for Environmental Information; 438 N. Skinker Blvd.; St. Louis, Mo. 63130; $10.00/yr in U.S., $12.00/yr elsewhere

Environmental News (irregular) Office of Public Affairs: Environmental Protection Agency; Washington, D.C. 20460; No charge

Family Planning Perspectives (quarterly) 515 Madison Ave.; New York, N.Y. 10022; Free to qualified personnel

Foreign Affairs (quarterly) 58 East 68th St.; New York, N.Y. 10021; $10.00/yr

Fortune (monthly) 541 North Fairbanks Court; Chicago, Ill. 60611; $16.00/yr U.S. possessions, and Canada; $25.00/yr elsewhere; $2.00/single issue

Futures (quarterly) Futures IPC (America) Inc.; 300 East 42 St.; New York, N.Y. 10017; $30.00/yr, $22.50 for individuals; $7.50/single issue

The Futurist (bimonthly) World Future Society; P.O. Box 19285, 20th Street Station; Washington, D.C. 20036; $7.50/yr; $1.25/single issue; Institutional membership $100.00/year

Harvard Business Review (bimonthly) Subscription Service; 108 Tenth St.; Des Moines, Iowa 50305; $12.00/yr in U.S. and Canada; $15.00/yr elsewhere

The Hastings Center Report (bimonthly) Institute of Society, Ethics and the Life Sciences; 623 Warburton Ave.; Hastings-on-Hudson, N.Y. 10706; Received with Associate Membership in the Institute; Dues $15.00/yr, $7.00/yr students

Impact of Science on Society (quarterly) Unesco Publications Center; P.O. Box 433; New York, N.Y. 10016; $4.00/yr; $1.25/single issue

Industrial Research (monthly) Circulation Department; Industrial Research Building; Beverly Shores, Ind. 46301; No charge to qualified persons in the U.S.; $9.00/yr to qualified persons abroad; higher rates to nonqualified persons

Innovation (monthly except Jul and Dec) Fulfillment Manager; 265 Madison Ave.; New York, N.Y. 10016; Nonmembers: $35.00/yr in U.S. and Canada; $45.00/yr elsewhere; $5.00/single issue; single issue $7.50 to nonsubscribers or nonmembers

Inside R&D (weekly) Technical Insights, Inc.; 60 East 42nd St.; New York, N.Y. 10017; $120.00/yr

International Science Notes (intermittent) U.S. Department of State; Bureau of International Scientific and Technological Affairs; Washington, D.C. 20520; No charge

LaRecherche (11 issues/yr, in French) 4 Place de l'Odeon; 75-Paris-6^{e}; France; 75 francs/yr in France; 90 francs/yr elsewhere

Minerva (quarterly) 59 St. Martin's Lane; London WC2N4JS; England; $7.50/yr by air in U.S.; $8.00/yr by air in Canada; £2.50/yr in U.K. and elsewhere

Monthly Catalog of Government Publications (monthly) Superintendent of Documents; U.S. Government Printing Office; Washington, D.C. 20402; $7.00/yr in U.S.; $8.75/yr elsewhere

Mosaic (quarterly) U.S. Government Printing Office; Washington, D.C. 20402. $2.50/yr in U.S.; $3.25/yr elsewhere; 70 cents/single issue

Nature (weekly) 711 National Press Bldg.; Washington, D.C. 20004; $48.00/yr in U.S.

New Scientist (weekly) IPC Magazines; 66-69 Great Queen St.; London WC 2E 5DD, England; $20.00/yr in U.S. and Canada (by air); £6.00/yr elsewhere; 25 p/single issue

News Report (NAS, NRC, NAE) (10 issues/yr) 2101 Constitution Ave., N.W.; Washington, D.C. 20418, No charge

The OECD Observer (bimonthly) OECD Information Service; Chateau de la Muette; 2 rue Andre Pascal; F 75 Paris 16^{e}; France; $3.50/yr (£1.15, F15.00, FS13.00, DM10.50); 80 cents/issue (£0.27, F3.50, FS3.00, DM2.50)

Physics Today (monthly) American Institute of Physics; 335 East 45th St.; New York, N.Y. 10017; $7.00/yr in U.S. and possessions, Canada, and Mexico; $10.50/yr in Europe, Mid East, N. Africa (by air); $8.50/yr elsewhere

Policy Sciences (quarterly) American Elsevier Publishing Co.; 52 Vanderbilt Ave.; New York, N.Y. 10017; $17.00/yr; $5.25/single issue

The Public Interest (quarterly) P.O. Box 542: Old Chelsea Office; New York, N.Y. 10011; $7.50/yr

Public Policy (quarterly) Harvard University Press; 79 Garden St.; Cambridge, Mass. 02138; $9.00/yr in U.S.; $10.00/yr elsewhere; $2.75/single issue

R&D Management (3 issues/yr) Basil Blackwell; 108 Cowley Road; Oxford OX41JF; England; £5.00 ($12.00)/yr, £2.00 ($4.80)/single issue

R&D Management Digest (monthly) Editorial Offices, Lomond Systems,

Inc.; Mt. Airy, Md. 21771; $24.00/yr

Research Management (bimonthly) P.O. Box 51; Red Banks, N.J. 07701 $14.00/yr in U.S. and Canada; $16.00/yr elsewhere; $3.00 single issue

Research Policy (quarterly) North Holland Publishing Company; P.O. Box 211; Amsterdam; The Netherlands; 91 Dfls/yr (about $28.50)

Saturday Review (weekly) 380 Madison Ave.; New York, N.Y. 10017; $12.00/yr

Science (weekly) American Association for the Advancement of Science; 1515 Massachusetts Ave., N.W.; Washington, D.C. 20005; $20.00/yr in U.S.; $23.00/yr Americas; $25.00/yr overseas

Science and Government Report (24 issues/yr) P.O. Box 21123; Washington, D.C. 20009; $25.00/yr in U.S.; $35.00/yr elsewhere (by air)

Science Forum (bimonthly) University of Toronto Press; Toronto 5, Ontario; Canada; $9.00/yr; $1.75/single issue

Science News (weekly) Subscription Dept.; 231 West Center St.; Marion, Ohio 43302; $10.00/yr in U.S.; $12.00/yr in Canada and Mexico; $13.00/yr elsewhere

Science Policy (bimonthly) Science Policy Foundation; Benjamin Franklin House, 36 Craven St.; London WC2N 5NG, England; £6.40/yr in U.K.; $17.00/yr elsewhere; $22.00/yr airmail; libraries and institutions higher

Science Review (Philippine) (bimonthly) Science Planetarium; Herran-Taft Ave.; P.O. Box 3596; Manila, Philippines; No charge

Science Studies (quarterly) Macmillan Journals Ltd.; Little Essex St.; London WC 2R 3LF; England; $13.00/yr in U.S. and Canada; £5.00/yr elsewhere

The Sciences (monthly) 2 East 63rd St.; New York, N.Y. 10021; $5.00/yr; 50 cents/single issue

Scientific American (monthly) 415 Madison Ave.; New York, N.Y. 10017; $10.00/yr in U.S. and Canada; $1.00/single issue (European subscriptions from International Distributors; Vlagstraat 128, Borgerhout 2200, Belgium)

sppsg Newsletter (10 issues/yr) 7310 Broxburn Court; Bethesda, Md. 20034; $10.00/yr for individuals; $25.00/yr for institutions

Technology and Culture (quarterly) 5750 Ellis Ave.; Chicago, Ill. 60637; $12.00/yr

Technology Review (nine issues/yr) Room E19-430; Massachusetts Institute of Technology; Cambridge, Mass. 02139; $9.00/yr in U.S.; $10.00/yr elsewhere

U.S. Department of Commerce News (irregular) Public Information Office; National Oceanic and Atmospheric Administration; Washington, D.C. 20230; No charge

Vital Speeches of the Day (semimonthly) City News Publishing Company; P.O. Box 606; Southold, N.Y. 11971; $10.00/yr; 50 cents/single issue

Washington Science Trends (weekly) Trends Publishing, Inc.; National Press Building; Washington, D.C. 20004; $50.00/yr

Waste Not (monthly) National Center for Resource Recovery Inc.; 1211 Connecticut Ave., N.W.; Washington, D.C. 20036; no charge

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